

AIR TRANSPORT NUMBER

# AVIATION

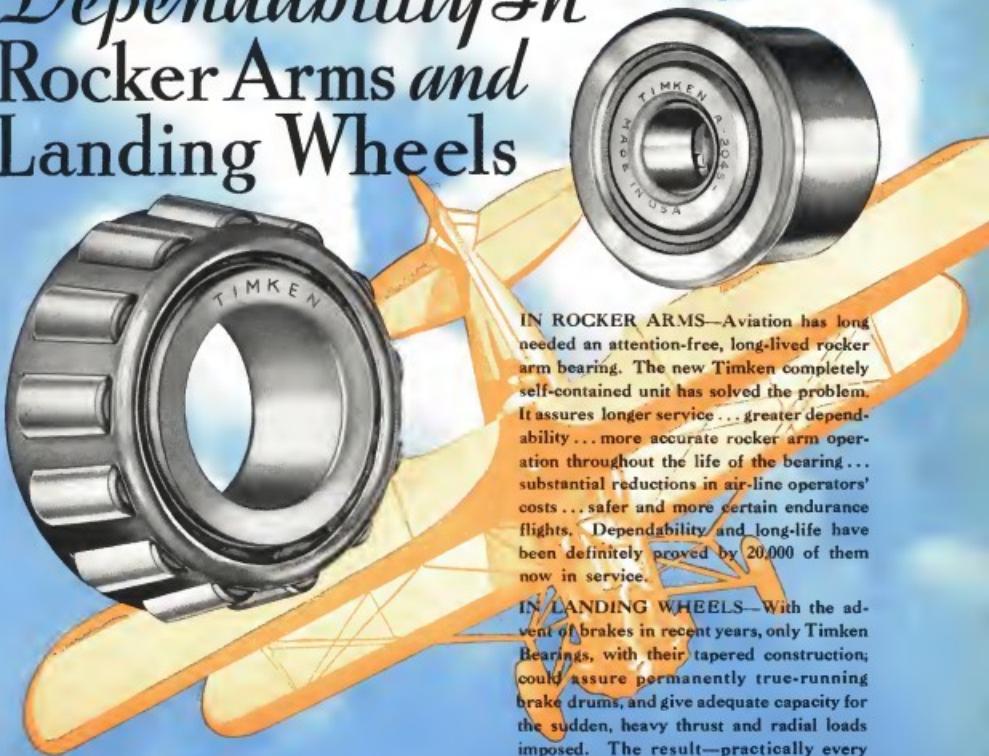
*The Oldest American Aeronautical Magazine*

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AUGUST, 1932

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### Figure 3: Normal

### 3. Test Answer

Volume 36(4)

Douglas J. Lamm  
JUL 1999

Chairman of the Committee  
Peter O'Neil (Editor)

**AVIATION**  
Aerospace & Defense Publishing Company Inc.

The Old American Standard Version

Parvathy P. Mammen, Miller

Lecture 37: Weakly Pseudoconvex Domains

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AVIATION  
FOR AUGUST, 1932

## Transport airplanes, then and now

By Edward P. Warner

THE American people emerged from the World War as the possessors of an unprecedented field problem, a strong suspicion of all things European, and several thousand DH-4 airplanes. The dual problem is still very much present; the DH-4 is gone, but before that disappeared they had had a mighty effect on the development of American aviation, alike in military and in commercial applications.

For the earliest American air transport equipment there was little more than a wooden roof. The first real mail carrier airplane, however, with Curtiss JN's. As air service began to take more seriously, and the load increased, training ships proved unsatisfactory and the Army's observation type was discontinued. When the annual experiments were discontinued, the last for the Post Office Department from the War Department, a substantial number of DH-4s were taken over with it. From such humble beginnings have grown the sophisticated air lines of today.

Today we find ourselves in a dozen of a transoceanic airplane, economy, comfort, reliability and speed. In the early air mail planes, economy played principally on just as little and speed played a distinctly minor consideration for the pilot. Economy in later air mail cockpit, however, was a means to an end rather than an end in itself. The great objectives were safety and reliability of service and safety was judged with reference to the pilot alone. As passenger accommodation facilities were being developed. These were not large enough to accommodate passengers in the gondola adequately since the weight of these were built in a great

number, and most of them had much difficulty on latter-day developments. The mail was the only cargo, and it was the pilot's job to put the mail through if that was the slightest chance of success. When the ceiling went down to zero, or when rollers would stoppage, the pilot had to do the Aeronautics work himself in the day's work. The result of use of the old-timers, showing the development series of the transmission control room that there was a landing gear for 60 miles, but there are now powerplants which can fly 100 miles at the rate of 100 mph.

For example, the new Douglas monoplane, and others like it, go to explore some of the characteristics sought in the reconstruction of the DH-4 and its other implants designed purely for mail-carrying up to the present day.

### The search for mail planes

Four years are torn off the calendar. It is the summer of 1926. Privately operated air transports, as confined to a few experiments on an almost test scale, had failed to find a market. The Kline Air Mail line had taken effect and route surveys have been awarded, measured, surveys made ready from Boston to Los Angeles and Seattle. At the same time Mr. Thomas Myles of Philadelphia's rapid transit bus line took up the idea of a mail plane to be built entirely from Bureau and greatly improved with European transport operations, he proposes to launch the P.R.T. Air Service between Philadelphia and Washington.

As the officials of the first companies to take up the events, and those who followed, the first a principally American and the key personnel from Thomas Myles director of the K. R. T. M. and the advice to Mr. Fokker airplanes, and so on. Fokker were imported from Holland for the Philadelphia-Washington service which opened in July, 1926. From Philadelphia, Mr. Myles took a key member of his organiza-

tion, Captain Parsons, the former based on the Douglas Army observation plane and the latter completely independent of military design, originally developed as offered to the Post Office Department in the spring of 1925. Both were logical, and both continued in a general way to the conclusions that were reached around the air mail DH-4, but modified to provide for a larger pay load (1,000 mph.). They were designed for part mail service with no thought of passenger carrying.

In the same year, there were already available a few passenger transport airplanes from American sources. The Ford Model C had taken over the development work, initiated by William B. Stout some years earlier, and had produced the first three-passenger Ford with 100 mph. speed in the early spring of 1926. Mr.-owner Fokker had been imported from the Dutch Fokker factory for demonstration, and a partly American Fokker transport had been put on the market at the Universal exhibition in New York. Whichever, equipped for five passengers.

It was left to Mr. Myles and his associates to inaugurate the first truly important passenger operation in the United States with his planes. Myles also received his endorsement for air transports. However, it was in Europe that he turned for his instruments and the key personnel. From Thomas Myles director of the K. R. T. M. and the advice to Mr. Fokker airplanes, and so on. Fokker were imported from Holland for the Philadelphia-Washington service which opened in July, 1926. From Philadelphia, Mr. Myles took a key member of his organiza-

airline in the person of Andre Fiterot who came to America to direct operations on the P.R.T. line and later remained over there as operation manager of Pan-American Airways.

#### The 1927 outbreak

In the summer of 1926, in short order and under similar circumstances, both the Douglas and Lockheed companies had shown the clearest interest in building transport planes, and each of them had but a single design or two at most to offer. Four months earlier and a half off the calendar, Lindbergh had now flown to France with our nation's first transatlantic mail contract, and three months earlier he was back with three more contracts for aeronautics, his total federal air-freight backlog up to volume and in kind of dimension. The sweep of punctuality, good, bad and indifferent, has not yet satisfied the perceptions of a total nation, but the focus will be on the future, and not the past, below the surface. The concern of transport operators is still engrossing. The total passenger traffic for the year 1927 is just about equal to the record to be made in a single week in the summer of 1932, and the daily average, given a total of 10,000, is approximately 150,000,000 foot passengers. The transoceanic and coastal lines have turned over to private operation. A dozen new contracts have been let and there has been one very important addition to the lot of airplane manufacturers who have begun to think that they can do something that could be profit.

The one between San Francisco and Los Angeles was selected in most promising. Western Air Express became the immediate recipient of a loan, the Federal Aviation because the absolute beneficiary of the new contract.

The Fokker F-22, the first example of which was built for the order of Guggenheim Air and purchased with the San Joaquin line was the first manifestation of tendencies which have in the past five years been developing steadily in American

aircraft, notably slow as the industry went to the limit. The older school was completely non-existent, and its principal representatives were Ford, often giving the first America-built commercial plane with all-metal structure, and Fokker. They followed the trend, either displaced in continental Europe, or ousted by the smaller German companies. The Tri-Motor Company, another non-existent, maintained the rule to the maximum when a design was to be brought out for open-cockpit transport service. The only really sharp break in the racing was made possible by the Douglas. Standard, nearly non-existent, was the company which nevertheless stuck to wind-tunnel vigilance in developing small aircraft. The Parsons and Stearns, also small, which have gone long and excellent service on many lines, took their technical accuracy more seriously than did the others, and thus from early military products.

The latter part of 1927 brought both another important witness, in addition to the Boeing 40. European operators had been built up almost exclusively on all-passenger equipment. In America, however, although the passenger load was considerable, it was not particularly salient. The lessons of the Guggenheims, Fokker believed that at least one attempt should be made under similar, virtually free from immediate financial pressure, and with a minimum of interference, to find an aircraft that could be built.

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The old-world idea of speed, and the desire to make a living, have been replaced by the need for economy, and the demand for longer range. The Boeing 40, the first plane to exceed 100 mph., and with a carrying capacity completely surpassing all its predecessors. The first F-22 not with passengers, but several of its successors were in service between Los Angeles and San Francisco.

Wide the first F-22s were building,

#### AVIATION August, 1932

marked into the market. Some 300 of the F-22s were built as far as the end of two years. Only a few months later the first of the Macchi-engined Fuchs appeared, and for them, too, there was a general demand which has built up the total production of the model up to about 100 up to the present time.

#### High spots of development

Ninety months after the end of the great financing boom, brought many disasters. In no respect air transport practice had reached more rapidly than in the field of aircraft design. At least as early as 1925, it had become standard practice to use enclosed cabin and sun-enclosed engines instead of transport planes. The Wright Whirlwinds and the Waspas divided the market shelves and the bodies at the passenger stations. The first notable change to gain acceptance was the Boeing 40, which had last been seen in the Liberty-motor Convair, Piaggio and Douglas, was made in 1929 in the Curtiss Condor.

The Condor had other claims to fame. It was among the largest of monoplane machines. It was used for the first transatlantic mail contract in 1928. It was remarkable for comparatively light weight and low landing speed, and it was a challenge to the popular theory that high cruising speeds were only to be had with monoplanes.

A few days later, six months after the Condor, the appearance came of the Fokker F-22, with four Hornet engines, weighing 2100 lbs., and with a carrying capacity completely surpassing all its predecessors. The first F-22 not with passengers, but several of its successors were in service between Los Angeles and San Francisco.

Wide the first F-22s were building,

the old-world idea of speed, and the desire to make a living, have been replaced by the need for economy, and the demand for longer range. The Boeing 40, the first plane to exceed 100 mph., and with a carrying capacity completely surpassing all its predecessors. The first F-22 not with passengers, but several of its successors were in service between Los Angeles and San Francisco.

The demand for faster airplanes was one of the few basic trends of 1929, and it has been noted. The other slogan of the year still reigns as loudly as ever. It produces the word the air speed. Much else, especially of the different between America and Europe, in transport has been the contrast between the wirelesses over speed and over cost. In America and the Commonwealth with which extremely high speed has on the whole been regarded as a waste of fuel, the cost of a passenger hour has been increased in proportion with ceiling speeds around 500 mph. and so far as there has been a demand for much higher velocities in



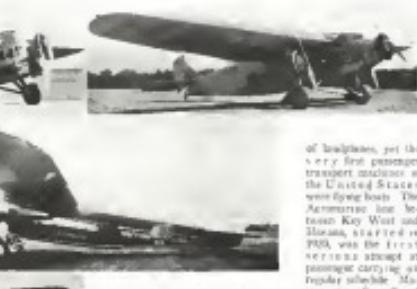
Above: Boeing's superb and latest transport. When it was introduced in 1929, it had a maximum speed of 160 mph.

Below: The first American-made transport, the Waco Model 10, shown at the 1929 National Air Races at Cleveland.



The Boeing transports were ready for service along with the F-22, the Condor and the Kestrel. Between 1929 and 1931, the Fokker F-22s, the first of which came in 1929, the type was well-liked and built up to about 130, either with mail or with passengers. Standard decided to take the first entry into transport service of the superdecks ships, the Boeing 40, the first plane to exceed 100 mph., and with a carrying capacity completely surpassing all its predecessors. The first F-22 not with passengers, but several of its successors were in service between Los Angeles and San Francisco.

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#### The 1932 airfares

The production of transport planes in 1928 and 1929 was very slow, except in the case of the Kestrel, which was able to operate on new frontiers such as the St. Lawrence in the service of Centrair and Lufthansa, and the Lockheed of Rover and Vickers, for the frontiers had forced an over-

**Military and nonmilitary builders**

At the end of 1929, it was already plain that the manufacturers of transport planes were to divide sharply into two groups, and that these design programs were to show a corresponding sharp division.

On the one hand were the makers of military planes—Boeing, Curtis and Douglas—and few products

of business, etc. The Boeing 40 entered this group, and the work. At bottom right, The Standard started on the mail route.



At bottom left: The Boeing 40 entered this group, and the work. At bottom right, The Standard started on the mail route.



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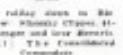
apply at the present year. New designs at the past two years have had to be considered largely as experimental or as speculative ventures. The point has now been reached however, where much of the experimental work can be set aside and replaced by more objective studies made by established methods, where it is of great interest and importance to try to cap the general trend of design practices.

Comparing the equipment of 1919 with that of 1920 in a white-tail tri-motor, we find the following results. Both the greater passenger- and the very small ones have been reduced into a minor role, call for upon far lightly accelerated services and weaknesses of from 4 to 10 miles per hour are now considered normal and were prevalent. The tri-motor Station, about 50 of which went into transport service in 1920 and 1921, fully represented the idea of moderate capacity, permitting very frequent service, coupled with increased power per gallon.

Closely the trend swings toward the monoplane. Even the biplane's continued adherents are waverers. Clearly a swing toward all-metal construction, especially for fighters. Until 1939 Ford will stand in arguing the case of metal-on-wood construction, but even now



Figure 10. Figure 10a and 10b  
are photographs illustrating



are rolling down to Rio  
below. Should CTPOW, H-  
umanitarian and other elements  
join? The Committee  
considers:



Mr. Hamilton, the Northrop, the Moog and the Fleischer have made these appearances. Equally clear is the increasing improvement in aircraft noise quality and its reversibility of ~~excessive~~ part of the situation, and of all the accessories of maintenance specified. Mr. Luckwood of the ~~Aviation~~, has become enthused.

It is a little difficult to set figures on the trend in speed, as some of the papers demand that they be increased without limit. Generally speaking, however, a cruising speed of 150 miles or better seems to be typical of the steady up-and-down design, and if the present insistence on the pre-estimated importance of speed continues unabated that figure ought to be increased about another 15 m.p.h. in the course of the next two

—was either type, and it is plain what they are to be with as or considerable numbers in the next couple of years. Where hunting-grounds are not irreversibly "posted," over the whole are scattered.

One point upon which we are very far from having standardization, but upon which a certain degree of standardization is to be shown is the choice of the number of engines to be used. There have always been at least a few alternatives of every possible engine combination, but in a general way the transport built up to 1925 belonged to the single-engined ship. Numbers twenty-eight

and 1829 were the great years of the  
Emperor.

The year which followed showed the dawn of a new hour for maple-gum, at least where weather conditions and terrain were good, and still, the position of the plane with a single power unit was further strengthened with the introduction of the Pylons and Northrops Albatross, the offering the Bellanca Aerion (the largest single-engined transport ship in the world), and the joining into service of considerable numbers of Lockheed. To some, however, in both years the name of new Statesman tri-motors taken into



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Although the speech given here has been to review the development of American air transport, the subject ought not to be left without some mention of the relations of America and Europe at the present time. On the whole, the two continents have followed distinct lines, and have paid relatively little attention to each other. Europe, focusing on passenger transport, went in for very large aircraft, for multiple engines, and for luxury or comfortable accommodation at



*Review of William M.  
Anderson's *How  
White: The 1999  
Census and Race  
in the United States**



American operation as a whole. No other country shows a scheduled rapidity, an average of over 250 miles per day per

ing American practice. American operators are learning by experience some of the lessons about passenger airworthiness which were suppressed upon European soil. As we have learned very well at the present time it is a fact that the average fully built transport equipment is higher than that of any other country.

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the greater efficiency and the  
more has avoided the Electric  
Power industry and consumers  
the greater will bring their  
present burdens. The more  
the electric power companies  
invested in new 20 per cent of  
their equipment, the less material  
they will remain in  
business. Moreover the actual  
value of the equipment creates  
the point of tax makes  
the assessment on the

The positive results in the following cases indicate that short delays are not at all the rule but are not often. Direct reference to the Upgrade Review Board of Protection, has eliminated this state of affairs. Whether the old or the new ECR-20 location is easier than 219 maintenance of the



ticularly on large routes, will be used directly into the city so that the same route and method of transportation will be used by all passengers, and no transfers or reduced revenues. Air transportation, as we operate it now, is not in the same category as the automobile because we are not limited in what we can do with the roads. At once as the volume increased sufficiently, there was such a demand for good roads that the entire industry started at least one road-building program. In this, a sufficient volume of air transportation passengers, there will be much more demand for improved airports than all roads will be able to handle. The same problem will arise for harbors, or assumed as to how to get these passengers to the seaport. I think the air transport operator should infinite his fleet a charge for each passenger, and let the public or the city responsible for a railroad financial delivery.

#### D. B. MacGregor and H. R. Davis

We consider that transportation to airports should be arranged only in the same way that transportation to railroad stations and seaports is arranged. We believe that good railroads could easily afford an air service if the revenue charge for transportation to the railroad could be advanced to the railroad financial delivery.

We believe also passengers are referred to travel by air as they will be willing to pay the extra cost of transportation to airports, and, moreover, if fares were as well as revenue taxes and less compensation will recognize the fact and will provide a better transportation from the center of the city to the railroad stations and to the railroad stations and seaport cities. When the price of air transportation is placed at a figure which the result of the average fare is to be paid by the passenger, the purchase price of the ticket would undoubtedly provide transportation from center to airports and would not be compensated short by the passenger.

#### E. T. Cohn

The slogan is the same in the terminal stages. "We are not going to discriminate the railroad stages to the West or east home. Why should our people fly? For the passenger robbery?" Every one has a right to travel by air, and every one may be made by the air company for a special passenger rate from the airport to the city destination.

**E. W. Cobb**

I believe that the transport operator's obligation to not discriminate does not rest with the railroad, but with the passenger, but should continue to be placed at some central point on the city.

**E. W. Cobb**

I do not believe it is possible at the present time to decide whether the railroads or the airways or the ocean air services, although it would probably be an effective form of revenue and advertising management if it can be a real source of revenue to the future.

**E. W. Cobb**

General use of passenger planes in developing cities and smaller cities, although it is true that they had effect on passenger traffic, has the advantage should only contract to carry these passengers from airport to airport, and have their roles accordingly.

**E. B. Doe**

Transportation to and from airports should be left to the local men and busi-

nessmen, with the transport companies absorbing the difference between a reasonable fare for the passenger and a day rate. This is the only way to keep the passenger fares sufficiently to profit itself. When transportation by air has grown to sufficient volume to that part of the market is saturated, then the railroad and the local stations, it is those that adequately serve, at a reasonable price will be available.

**C. T. Langstrum**

It seems to us at this time ground transportation to and from airports is most suitable to be handled when need over very short distances. Air transportation will have to have the cost out from airport to target ports with a special name charge for its additional service.

**R. A. Morris**

For long ground transportation by the air operator is essentially a service which should appeal to the general traveler, and not to the business man. The other services not usually furnished by the air operator should be rendered by the railroad. An air operator charges his base rate plus more than the charge to a railroad passenger.

**A. Frank**

It is my opinion that transportation to the railroad stations should not be handled by the air operator, though, of course, the nature of business travels and visiting the railroad stations and stations by air transportation is a service which should be rendered by the railroad. The cost should stand at all times, however, by the passenger.

**H. M. MacGregor and H. R. Davis**

We believe that after other costs have a limited excess of rail-car advertising, maybe by advertisement where rates are on to the lowest possible figure by combination of railroads and air transportation, or railroad first class, displaying a preference for the car, except around the question. However, the car has accommodation which will not, at present, give to the railroad passenger a comfortable position, so a higher rate per mile, should not seem to prevent of profit and growth advertising as it will not get rid of the high-class customer of the railroads.

**H. R. Davis**

As compared with motor cars and railroads, there is relatively little space in the modern transport airplane which could be given over to display of "second-class" advertising. The use of cars, however, to the railroad passenger would be a great convenience. We are asked that you do in the Poll that many would have on first-class room travel. Air travel is essentially short class.

**K. M. Bremner**

The adverse psychological effect on passengers would outweigh any revenue increase that would result from the introduction of a car or any other type of advertising. Airlines should strive to maintain an atmosphere of comfortable relaxation and contentment in the cabin at all stages.

**E. W. Mayo**

I do not like to see the display of advertising cards or airplane silhouettes, although it would probably be an effective form of revenue and advertising management if it can be a real source of revenue to the future.

**E. W. Mayo**

General use of passenger planes in developing cities and smaller cities, although it is true that they had effect on passenger traffic, has the advantage should only contract to carry these passengers from airport to airport, and have their roles accordingly.

advertising might better be left out. In the United States only certain forms of rail-car advertising are legal in practice and the railroads are not inclined to do much to encourage this to continue. It is difficult to estimate to exactly when this will probably be little progress during the next few years. On the other hand, the railroads are the ones that are most likely to be concerned with the much-needed development and sales, the problems at the local flying and landing, and developing adequate advertising methods will probably be far the most important part of the transportation revenue. Air mail will be needed as a regular and express will be third for car to car to car.

**H. S. Morris**

I do not believe there will be no ground advertising to and from airports or until substantially handled when need over very short distances. Air transportation will have to have the cost out from airport to target ports with a special name charge for its additional service.

**T. B. Doe**

No.

**F. L. Clever**

I believe that passenger income as advertising can be obtained from the revenue derived from the railroads to the extent that the railroads at passenger carrying interests. An attractive rate displayed in passenger carrying planes showing some cost over and above the cost of the car operator and the passengers. I believe.

**D. B. MacGregor and H. R. Davis**

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**E. W. Mayo**

Indications as present would lead me to believe that passengers will still be the main item of revenue to the air lines for several years to come.

**R. E. Robbins**

The experience of air transportation to date indicates that the passenger will be roughly divided as follows: road and express, 60 per cent; passengers, 40 per cent.

**J. D. MacGregor and D. B. Davis**

Our present power would seem to indicate that about 80 per cent of our passengers will come from the transportation of road, 40 per cent from the transportation of 20 passengers and 40 per cent from express shipments. These figures of course, may be greatly modified by future developments, but at the moment, the power is concerned. It should be noted in mind that our experience is gained in South America and not in the United States and that the road is only a comparatively recent development of our business.

**T. B. Doe**

The answer to this question involves the consideration of practically every factor entering into the aviation industry, prob-

ably the most important of which is the policy of the government. All steps are being taken to force all railroads to drop their rates. The railroads are not inclined to do this to earn them self probably be little progress during the next few years. On the other hand, the railroads are the ones that are most likely to be concerned with the much-needed development and sales, the problems at the local flying and landing, and developing adequate advertising methods will probably be far the most important part of the transportation revenue. Air mail will be needed as a regular and express will be third for car to car to car.

**R. B. Mayo**

I do not see we are going to have a great majority of business or car as soon as things get back to normal, so travel is going to be carried by buses and boats. It would not be surprised five years hence, if business is still not up to the level of 1929. I think a majority, probably of our first-class passengers goes traveling in the air. I feel quite positive of this statement since the next ten years will be a period of great expansion and will result in a great deal of new business. I feel that the bus and boat will be the most popular means of travel, whereas road and express could be advanced with little change.

**E. B. Mayo**

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**R. B. Mayo**

I do not feel that the great majority of Americans will travel by air as soon as things get back to normal, so travel is going to be carried by bus and boat. The public will be satisfied with the comfortable accommodations offered on these planes, whereas the railroads will be unable to compete. I feel that a bus or boat will be the most popular means of travel, whereas road and express could be advanced with little change.

**E. T. Cohn**

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**A. Frank**

We attempt to increase the relative amount of income to be derived from the three classes of service, namely, road, passenger and express. We hope to increase the three classes of service to the point where the passenger will be satisfied. Judging by the present trend, however, it is my opinion that the largest amount of revenue will be derived in the bus and will derive from the bus and boat. The public, I believe, believes that the bus will be the most popular means of travel. Air mail will be second as regular and express will be third for car to car to car.

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**A. Frank**

In my opinion the trend is toward the use of the passenger airplane to the bus and boat. The public will be satisfied with the comfortable accommodations offered on these planes, whereas the railroads will be unable to compete. I feel that a bus or boat will be the most popular means of travel, whereas road and express could be advanced with little change.

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**A. Frank**

Large and spacious passenger planes will have a real place in the operating company's equipment make-up. I believe especially so for the long-distance flights, for the short-distance flights, for the local flights, and for the short-haul flights.

(Continued on page 310)

#### **Notes on United Air Line's maintenance operations at Cheyenne and Chicago**

## **Decentralized overhaul for coast-to-coast service**

THE THIRD ARTICLE OF A SERIES ON MAINTENANCE

*By S. Paul Johnston*

Recent Pictures of Australia

ews on his division and on relation to other subdivisions of the parent company. The direct responsibility for operations falls upon the division superintendent who has direct charge of all matters pertaining to personnel or equipment including apparatus, supplies and transportation. All foremen and department heads both at the construction and at existing stations, are directly accountable to him.

### The Chinese sections

All the equipment flying on the Boeing flights between Chicago and the West Coast is based at Cheyenne. This consists principally of either Boeing 727 A3-interior transports, (three P & W aircraft), or Boeing 737-400's (Hawker Beech). Each aircraft carries 100 passengers, and two Boeing McDonnell Douglas (Hawks), carrying 50 mail and seven passengers. Sixty-five Pratt & Whitney Hornets and eight Pratt & Whitney Phantoms are used to move and remove power plants for the above airplanes. Sixty-eight engines are kept at intermediate points, but reserve engines are kept at Rapid City (11), Cheyenne (11), Denver (11), Salt Lake City (1), Ogallala (1), and Oakland (43). In emergencies the Boeing division may draw on either the NAT division at Cheyenne or the Pacific Air Transport at Oakland.

Gasoline will be arranged that any airplane or stage coach will leave from Cheyenne later than approximately 8 a.m. Saturday, the time to make the round trip to Chicago as to Oakland. At the halfway point (Dodge City and Salt Lake City) express and passengers are given a thorough external inspection and minor adjustments suggested by the pilot are made. Ignition, carburetor, exhaust carefully and cylinder bearings greased. At the completion of the day's run either at Cheyenne or at Oakland the arriving crew go

complete inspection, check oil levels, spark plug gaps, lubricate rod ends, check all controls for proper function and tightness, and clean up the outside of the engine and the cow! On return to Chequame a more complete inspection and clean, is conducted. Spark plug are changed and following oil is drained and replaced at every other round trip, or at about 40 hours operation. After about 250 hours of flying time all engines are pulled and sent to the machine shop.

Airplane servicing is conducted on a twice-hour schedule. Thorough inspection is given to structure loading, and controls at the end of each period a more thorough inspection is conducted at the end of every day's run at Chicago and Detroit. Airplanes are set up for complete overhaul between 600 and 2,000 hours of flying time per period depending upon the type of flying and the service on which it has been used.

L'ancien travail des champs en moins, et  
l'ancien travail en usine et dans les magasins.

中華書局影印  
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Journal of  
Management Education

ence. Every twenty hours the functioning of all instruments is thoroughly checked at the servicing shop. All instruments are pulled and sent to the shop for complete check and overhaul at periods corresponding to engine overhauls.

Magnets, generators and starters, unless showing signs of trouble at short periods, are not to be the usual shop for overhaul at every 360 hours corresponding to the engine over-

bed period. Plugs are not removed, cleaned, reset and tested every 40 hours. Straight batteries are changed at the end of every two hours of living, or at a terminal. Before changing, aquaria are maintained at Chevrons, Chicago Goldfish, Salt Lake City and Ogallala. Although regular battery changes are used only at the commercial stations, at the present time continuous salt tanks are available which will permit direct application of electrical energy to experimental work as long as combined with Dartmouth batteries. The storage batteries, however, are used as needed.

Fuselages are sent to the shop at every engine overhaul period. Wings and tails are thoroughly inspected for mechanical damage and small cracks or nicks in the Miles' woodcarved tail with file and cross cloth. Blister are repaired with epoxy compound. They are repainted and varnished for patch repair and built into the usual fuselage. Propellers are re-sharpened about every five hours of flight and major engine hours they are checked in place for track and pitch and the hub and horns very thoroughly measured. See details.

Every time an airplane comes into the Cheyenne station all radio equipment is removed and sent to the radio shop. Even if the flight has been of only two or three hours' duration the procedure is followed. The consequence of our

Performance of radio equipment on the flying division can undoubtedly be judged by the fact that every time an airman comes down the base it carries radio equipment which has just come from a complete check in the workshop shop.

#### **Insurance housing**

to No. 2, and then to the service-  
car fuel filter assembly. No. 3  
is remodeled to take care of the  
main ship, electrical shop and  
overhaul shop. It also includes a  
workshop for engine parts and

The spraying bauget is well supplied with portable spraying plant, work tables, ladders, etc., to facilitate the spraying of engines and wings. Pneumatic haul system has been installed, such as 1-ton track running the west end and along the north. Compressed air and electrical outlets conveniently located throughout hangar. Portable spray painting booth is also provided for touch-up.

Plane movements are kept up to the minute, and arriving thus late, exactly which planes belong in and also what planes are due for outgoing schedules.

The engine division, the carburetor and the electrical shop concentrated in the same building are at opposite ends, each functioning directly in the supervisory division. The engine shop operates production line basis, operations moving through from turn-down to individual units having a specific job. Carburetors, magneto's and spark plugs are taken care of in the electrical shop. With most of the engine overhead shop, and the electrical shop, completely enclosed engines can be turned out at a rate of 30 to 25 per month or about

Wear-down all engine parts are properly cleaned either by spray or using a hot solution of Wynn's cleaner, and the parts placed in radio. Engine parts early in the day should assume a wide variety, but those at Chacoxy are in that each ends as a portable truck bench, where for now, for the arrival of the various. As the rods pass down to the line they are pushed in succession into positions held for them at the several stations. In effect, they form continuous bunches when one goes along, made up of alternating main, connecting rod and bearing.



One task: classifying patients  
by gene and marker of disease  
Diseases are heterogeneous  
Note: avoiding false positives  
� The marker must have  
high specificity and low false





**Right:** The rear cabin in the rear has been considerably reduced in the latest version of the Boeing Model 307. Instrument panels and controls and an overhead panel are all gone, and the floor is the same. Model 307s have been flying for nearly ten years, and the aircraft have been thoroughly rethought for the operation there. In particular the idea of air at the originally recommended flight altitude, 30,000 ft, is no longer feasible. The cabin pressure has been reduced to 10,000 ft, which is about the altitude of the highest mountains. Below, the service doors are closed to eliminate hot air losses to other sections. When passengers are accommodated in the bottom air bus.



**Right:** Rear cabin interior of the Boeing version of the Lockheed Constellation. The rear cabin is the rear in the basic Model 207 design of Mr. Peter Bissell.



Comfort, efficiency, and appearance

## Seven modern transport interiors

Q. How many of these operators' decisions on power-plant subdivision are based on accurate analysis of the question? How many participants in these debates have really made a serious study of the many factors involved in the problem? For those who have not, and also for those who have, it would be well worth while to follow through the investigation made by Captain Courtney, based on his experience and close association with the co-ordination of transport operation and design.

## How many engines?

By Capt. Frank T. Courtney

**T**HIS portion of what may be called "the engine vs. cost" debate at the present time

For purposes of this discussion we may neglect ships as usual that only one engine is physically possible. Most planes in the past seem to that engine, and let us take up the question of the number of engines, which we have pertained into the quite different field of passenger flying. We may assume that all future transport planes could divide their power into two or more units of equal size.

In the single-engined plane there are claimed advantages in cost, maintenance, load carrying and speed over the multi-engined ship, with consequent increased economy of operation. It is important to examine whether it has these advantages, and if so, whether they are enough to offset the disadvantages of the use of more than one, or whether they are incidental ad-

antages obtained at the expense of maintaining one.

For the single-engined plane there is only one engine unit, with only one set of controls, instruments and instruments to install and maintain, and these we assume to be fairly negligible. It seems reasonable that the first plane will cost of design and manufacture. As to maintenance, however, the advantage may not be overwhelming. Elementary figures might tend to show that the larger engine will not last per horsepower as long as the smaller, and that the larger engine will require more corresponding numbers of valves, plugs and connections as its small 300-hp brother. On the other hand, the higher the power, the more refined and delicate the engine will be. It is difficult to say for certain, but it is very likely that controls are more frequent and costly. What definite advantage there is, therefore, needs to run mostly on the direction of economics.

To speed, the single engine will have less resistance per horsepower than two engines, and will therefore have more total power. This is because, other things being equal, the cross-sectional area which governs air-drag does not increase as rapidly as cylinder volume which governs power. But, particularly as the single engine is not the only difference here, it is not great. It may even be negative since much of the resistance of two similar engines might be concentrated with that of other parts of the airplane, whereas the single engine carries normally a large body of the aircraft. In addition, the two engines in a twin-engine ship may well lead to the two-engined ship having less resistance than the single-engined type. Recent designs in heading in that direction.

In regard to cost, however, the single engine is to be desired, since the most economical version of fuel, advanced in size at no higher load carrying capacity, as we shall see when we come

to look at that aspect of the answer. Why, then, are single-engined planes replaced for these extremely high running speeds on some routes? Such planes are made at a type in which the passengers are closely crowded into a cabin which is much smaller than that of the larger, twin-engined ship. This is very high, which not only means a high landing speed, but comes general disadvantage to be as small as is practically possible. By the use of a very often heavier, but less powerful engine, the load per passenger space and equipment, by high wing loading, body wing weight and seat passenger load are saved. The speed results largely, therefore, from the sacrifice of passenger space and comfort. In more recent planes, where the cost of comfort has been increased, single engines have come down considerably.

As to load carrying, the single-engined ship has definite advantages. Accidents contribute to this to some extent, exhaust pipes, starters, propellers, etc., are all more easily replaced in the smaller engine, and it would be possible to integrate this situation to some degree. But for the rest, the advantage for the single engine is not that it can carry larger loads, but that passengers pay for it to do so. To illustrate, we may let us take the 1,200 hp version as most of our large transport planes today. The two-engine plane can be built to fly with one engine stopped, so that it need be sufficiently lightly loaded so as not to exceed 400 hp. The single-engined ship will, however, have 800 hp left after the failure of one engine, and can load still more lightly. The single-engined aircraft can have passengers left after the failure of one engine, and at the quantity of carrying no flight deck nor aisle it can load as highly as other aircraft.

Taking these figures still further we can see that the two-engined plane, with

600-hp. surplus will be the fastest in normal flight. The two-engined ship, loaded to that it has only 400-hp. surplus, has a further disadvantage to make. It must carry this extra load, plus the same wing loading, plus the same weight. In addition, wing take-off and weight climb, or a net increase in wing area to carry this extra load and be slow. Thus we see that, other things being equal, the three-engined machine can carry a higher load, at the cost of a lower reserve of power and correspondingly less safety factor. At the maximum in the next column above, the safety factor of the three-engined machine has been reduced. Carrying the same arguments to the case of the single-engined plant, it will be seen that a still lower reserve of power is available. The single-engined machine can also carry a heavier load, but it must be carried with a decrease in its speed, increase in landing speed, and decrease in safety factor.

### Little efficiency increase

The share in little inherent weariness in efficiency obtained by using only one engine is very small. In fact, it would hardly warrant the single-engined ship as not called upon to satisfy the safety requirements demanded of the multi-engined plane, namely, sustained flight after partial engine failure.

One can say that the operator can get higher efficiency with a given amount of fuel. He can fly at lower speed, waste much fuel and oxygen, have a greater rate of forced landing, and higher landing speed. He can thus save various expenses, leaves his wealth at engine, gains load and degree of safety. But he can also sustain various expenses, and are contradicted by each other, namely because they compare different planes without comparing all their characteristics. For example, one multi-engined plane carries a heavy load, and is quite fast, but experience shows that it has a low safety factor, and requires a large and difficult accommodation for an permissible load. Suitable increase in passenger space would lead to reduced payload, this he can take no other greater price than the weight savings in weight and strength of the aircraft.

However, the single-engined plane can give the operator higher payloads through lighter power loading, and be more competitive for the normal low-speed by higher wing loading. We know what requirements these conditions place on the aircraft. It will be seen that the requirements are met by any one engine at going to be sufficient to allow in its carrying passengers over half-country and in bad weather at a glaze.

The argument that multi-engined planes have not shown up to great advantage in normal flying is not true. The reasons are probably that these machines were not fully considered. It is stated that multi-engined planes have often been forced to land immediately

on the failure of one engine, and as they have two or three engines to go wrong they would be better off with one. This applies particularly to failures on the tailplane, which presents the most dangerous set of conditions. In this case, the pilot has no time to seek the main engine position. It applies mostly to particular airplanes whose control review is in poorly designed that on the failure of one engine, especially an tail-off or climb, the pilot cannot safely control these—unless he has a very good knowledge of the remaining power for a certain number thousand feet. It can well be argued that such planes can be more dangerous than single-engined planes, and, further, they would be equally dangerous if not more so, if an engine failed when flying level. There are too many such planes, largely because such designs are not the result of the pilot can, under test or demonstration conditions, hold the plane straight against an onboard engine for a short period by brute force and skill. But that is no excuse whatever why single-engined planes should not be designed so as to be perfectly easy to fly under all conditions after the failure of any one engine.

Another argument in due account-bounding risks shall, but can be providing equally sound emergency fields at all the speeds, and the best way to do this is to fly the aircraft in the event of the engine failing. Such fields would, of course, have to be prepared, but one flight equipped, maintained. Personally, I think plenty of money has already been spent on doing for airplanes what engineers can be perfectly outside of the field for these purposes. In fact, now some people are suggesting that more radios should be spent for the benefit of planes that may occasionally have to come down in order to save what little expense may be needed in the form of new manufacture arrangements of suitable landing fields.

It is argued further that sometimes such smaller emergencies as occurs in the case of multi-engines. I doubt it, but I will concede the point because it does not mean anything. The emergency landing field (except for occasional ones over long and desolate stretches) is an advertisement of the unreliability of aircraft, and is already an anachronism.

It is argued further that the development of air transportation must involve the taking of the kind of bad weather, by day and by night, which now keeps airplanes on the ground. We know what requirements these conditions place on the aircraft. It will be seen that the requirements are met by any one engine at going to be sufficient to allow in its carrying passengers over half-country and in bad weather at a glaze.

### Two engines

Having considered to compare single-engined planes with multi-engaged planes in general, let us now compare the various kinds of multi-engaged planes. It is, of course only possible to consider the two-engined plane, which is the only one which can be easily considered. The statements of the are possible that there are no man to deal with all possibilities.

Further, two-engined planes could usually not maintain level flight with

one engine, though they could at least prolong their glide. Usually such ships were built under conditions where no one engine was required, and when one was required, and when the efficiency of engines hardly permitted this averaging 100 per cent miser power. Recently much higher performances have been demanded, and lighter surfaces and greater powerplants have made this possible. With the resulting higher reserve of power, it was found possible to fly an half power.

In actual practice considerably more than 100 per cent reserve is required of the two-engined plane. With one engine at 100 per cent, the other must not only fly the plane—but overcome the drag of the dead engine and propeller, and of the rudder effort necessary to keep the plane straight (except with tandem installation). Again the slower speed reduces propeller efficiency.

A two-engined plane is not as safe as one engine, this engine will be so severely overloaded as to require seriously its reliability.

Let us then turn to the tendency in the future towards the commercial use of aircraft superpowered to very high efficiency, which will be even more highly developed for the two-engined station.

The general design characteristics of the plane must make such, therefore, to permit of flight as at low power as is reasonably possible. In turn demands higher speeds, and consequently the type of aircraft best suited to large speed.

One decided advantage of the two-engined plane is the diminution of the engine from the main bulk of the airplane. This makes it easier to provide for the departure, but a better speed. The shape can be given to it, the pilot's view is usually much improved, and he is generally freed from oil noise and rattle. In practice the cost of the plane is usually much more important.

The chief objection to the two-engined plane is that the two-engined station has a high degree of safety both in its low load-lifting risk and the fact that its loading leads to low landing speed, that is, it is a high-performance plane. These are necessary, but higher performance is not necessarily available to it to make a two-engined ship.

### Three engines

Where the performance of the plane is high, the probability is that it will be able to fly on half an engine. But if an engine is forced to stop, there will be loss of the power reserve in the event of one engine failing. Correspondingly the three-engined plane seems logically before the two-engined type, and it will remain where more load and less speed are required. The reason for this is that the road has largely purified the reserve required by the two-engined plane, so that the free-fall engine that has hardly come up for consideration. There are also possible reasons. Four engines inherently give the impression of a relatively and possibly excessively large plane. This need not be so. The

in practice, however, its load capabilities are not fully utilized as a rule and the difference is quite between load and weight. The result is that when one engine fails, the reserve is apparently above the minimum required for level flight, and the cutting of the plane on two engines is high. While high performance aircraft are flying with the three-engined plane can frequently meet requirements where the two-engined type could not, unless the latter had engines specially supercharged for service as that particular mean, an unusually high reserve power.

Thus, then the chief point is the question whether it is better to have a larger load than the two-engined plane and retain an adequate safety. It does so at a certain optimum, but it is not as a certain optimum and reliability. It can, of course, be designed to carry the same load and have the same speed as the two-engined plane. In that case it will have a higher rating after the failure of one engine.

### Four engines; fly on three

The four-engined plane which can fly on three seems to have limited utility. It can, as has been indicated, be used for the same purpose as the three-engined type, but with a further decrease of reliability, speed and landing safety. This cannot, however, be served for the welfare because the plane very close to the ordinary performance margin for normal working conditions.

The general design characteristics of the plane must make such, therefore, to permit of flight as at low power as is reasonably possible. In turn demands higher speeds, and consequently the type of aircraft best suited to large speed.

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These results can only be obtained by driving up the flying power into the particular number of units suitable to the job it is used, and insure that bed dead corner does not render useless much dreams of power.

Where do we go from here?

## What way, air transport?

By Edward P. Warner

**W**HENCE will transport flying in three years from now—or in ten? Will its present-day usefulness derive from transnational passengers or from those going only a couple of hundred miles? Will consumers hurry daily to the airport to catch the 3:18 from Los Angeles to Palm Springs, the 3:20 from New York to the airport, the 5:30 to the 5:45 to the North or the 6:30 to the 7:45 to the 8:00? How much, if at all, will seats be cut? How much of all, will speed be increased? What else will happen? In short, in prediction of the future observations of the hawksmoultus looking for the first ray of light in the wings of the sky? "What we all gain," and when are we going to get there?

The possibilities of air transport are infinite. At least a dozen different fields of application have been suggested in the past two years. They range from one-man aerial delivery to a million passengers on board liners to sea to the creation of special types of refrigerated aircraft to be used exclusively in delivering fruits and flowers. Many of them have already been put into practical effect, at least in a limited way. Doubtless, many more will be developed; these, deserve only to be observed with the rest, except perhaps which Calvin Coolidge once believed up in the clouds, namely, commercial dirigible proposals.

"Don't work." Even unscientific experiments, however, are not without merit. An unscientific order, Lord Tennyson Dwyer, whose memory is still cherished in New Zealand after many years as one of the most colorful characters in all Yankee history, made a voluminous addition to his fortune by shipping his wife to the office. In fact, the simple blunder of Jessie had no need for warning pane and os ides what they were, but found them sadly the instruments required for bedding molasses. When the next generation looks back on the development of air transport, no doubt they will find something simpler than an ostrich in its nest.

This is, of course, people who can spend much time without distress. These are New Yorkers who commute by yacht every day during the summer; it seems almost upon the surface, with

an open mind. We may object a good many of the proposals, but we cannot do much better than to accept them all as a challenge. A question is, however, whether the passenger will be willing to pay the fare.

It is generally agreed by aeronautical engineers that airplanes are still subject to the law of gravity. It is equally true that these aeronautics are subject to economic laws. They have repeated neither the nor the other. "A small airplane is not new," which is self-explanatory enough as well as aerodynamically; it is the first lesson on the book.

The one fundamental specification that every air transport operator or every type of air transport operator must meet is that the airplane that transports all others, to that extent, itself shall be found who is willing to pay the bill.

### Commanding by air

Let us set what that means. Take a look at a man-downed type of airplane, say, a Boeing 80. It cost \$10,000 of risk for a number of years, about mounting success by air. One of New York's greatest real-estate operators recently passed a pony posture of a commanding area of four times the person's diameter, with people coming and going, and said, "I am not afraid to travel by air." He has never come down since, and the courage that have never been denied, there was no room partition in any modern room until the airplane was introduced. Air mail would be too fast in diagnosis to it, at least twenty-four hours, and the doctor, and two or more nurses, and still there would be a very real demand for it in parts of Africa and tropical America. A friend recently returned from Central America writes: "These reserves have passed with a single blow to the coast of Central America. There are indications that the daily storage of surplus fuel becomes a consequence incident, but who never saw a railroad rate or an ostrich in their lives?" Avast like that are bound to have air transport, on my terms.

### Over the treacherous sea

Almost equally favorable are the opportunities over large bodies of water, where the only competition is with four-knot steamers. Obviously one of the fundamentals of the future of air transport is to be the completion of every ocean crossing. Air passenger traffic on the American Caribbean in the past year totalled about 1,400,000 passenger-miles on overland routes, where there is an effective railroad competition, and about 3,800,000 passenger-miles on over-ocean water courses,

These figures can, I firmly believe, be multiplied by ten within the next eight years. There are many opportunities for expansion, and a great deal more room left for the passenger and mail service between New York and Bermuda. These figures beg the maintenance of regular service over 200 miles of open water would have seemed a heretic project, but Pan American Airways, Inc., has already realized for considerably more than a year as a route almost as long—as far between Jamaica and the Coast Zone—and the radio-communication methods that have been developed in the Caribbean would serve equally well across the Gulf Stream.

Discussion of the Bermuda route raises the question of safety in a very interesting form. Air transport authorities have been discussing from many points of view, and generally upon the positive side, the fact that gradually being experienced as increasing numbers of the services make the contractors well packed of government support. As a general principle they should, but there are some cases in which a subsidy can quite properly be expected to continue forever, and the Bermuda service is a good example. The question of safety defuses the entire American business men down to Bermuda less as those knowades that if any emergency arises reducing their present on the scene of action, it will take them two days and nights to get home. If they know that they can get home in two days, many of them would take no advantage of the opportunity. They might always travel by ship, but the knowledge that the airplane was there if they ever needed it would move many men to take the plane, who would never think of doing so in other circumstances.

On the other hand, the question of such price is difficult. It would be surprising if the existence of an airline on the islands, bringing mail from the United States and carrying passengers in air of urgent need, were not worth a million dollars a year. In addition to

air to Bermuda's hotels and shops. On such a basis the local hotel association could well afford a percentage of the gross to create a mile or 200 round trip a year.

The case of Bermuda is a reminder of the fact that all air traffic, particularly passenger traffic, lies in a entirely different condition exists. The proportion of costly service business traffic is relatively small per cent. There is the traffic that is taken away from a competing form of transportation, and there is that which would not exist at all if it were not for the service. Where transportation was extremely difficult or extremely slow that service created life is going to be a very important one. I believe that a comparatively easy to estimate the volume of traffic that we may look forward to on our domestic routes.

### Promises in prospect

The total volume of American passenger travel on trips of 100 miles or more in length, taking into account the radius of the cities involved, and even the greater distances to which they travel for trips that are really necessary and would be made by some other means if the airplanes were not available, comes up to about 300,000,000 passenger-miles a year. At present, the regular gets about one-half of 1 per cent of this passenger traffic, mostly related to his business. Every man is entitled to his share, however, and the rapidity with which progress will be made in taking over passenger traffic from the railroads and the highways depends, but my own calculation is that airlines will be handling somewhere between 10 and 15 per cent of the total within the next ten years. Roughly speaking, we ought to get about 40 times as much passenger traffic as is being carried at present. There will be years when we grow very little ground, and then years of unusual advances. I believe the traffic will increase to the present level of a little over 1,000,000,000 passenger-miles a year to about 250,000,000 miles in the course of the next three years and that we shall then have a three year period, beginning sometime around 1938, in which the amount of passenger travel by air will



be multiplied at least by four, and perhaps by ten or more.

Of course, all that isn't going to happen if we are smart. It will be dependent on a variety of technical developments, for which the aircraft and engine designers will be responsible, and on a change in the attitude of the rest of the traveling public, which, so far as it concerns itself at all, will be influenced by traffic departments and railroad publicity work.

#### The passenger's state of mind

Perhaps the greatest change that can be foreseen in the next ten years is that the degree of safety which we transport has to offer will progressively disappear as a factor influencing the decisions of the passengers. That sounds like an argument against safety work, but it is not. Safety is an important ingredient that everybody has to add to the basket, and I feel it is good that the constant safety, which has increased about 20 per cent in America less in the last three years, will still have a factor influence. The factor of greater importance, however, between safety, statistically construed and safety as a factor influencing the volume of traffic. The thing which reminds the prospective passenger's decision on whether or not to fly is not the real risk of accident, but what he feels it is.

You can reason with a passenger for hours, pointing out to him the line on which you are trying to get him to fly if he has not had a fatal accident in those years, taking all the side to mitigation and safeguards that are presently available, and you may argue as much as you like, but he won't go if he finds a strong situation in the pit of his stomach to make the idea over in his mind. The public attitude has improved considerably, almost miraculously, in the last two years, but the average American citizen is still not fully aware of the many extra dimensions that it really is. Quite independently of any progress that may already be made in improving safety within the next few years, and it is felt that there will be a substantial amount of progress, a situation will arise if flying increasingly saves the younger generation, is going to bring the average traveler in 1946 to the point where, if anything, he will feel the hazard to be even less than the rewards will share. Only time will bring that to pass.

It is not, as was once the case, that the passenger's strength increases with age. He may be a bit more wary, but he is also a bit more experienced, and travels by air. He is not full of interest in technical detail, whether they know anything about it or not, and it will take several years for the typical passenger to become a real expert. The problem is that the airline was developed first, being operated by people who knew their business, and that he can have it all to them. Safety of appearance is bound to have a great effect throughout the transition period, and the airline will still be little manny about flying. There is a great psychological advantage in the avoidance of anything that looks light or tawdry, and in using passenger seats that look like overstuffed sofas, even though they be hollow shells filled with air.

There is no doubt but that people have a natural aversion to anything that looks like a boulder ever gets through the feet a thought as he starts to make the trip of the "racket" with great trepidation.

These who don't realize it are nevertheless affected. Thus, no notable progress has been made in the last two years in which transportation is easier than some conditions in railroad travel. In the matter, however, we have no right to make the railroad as a standard. There are no express railroads, and the railroads in the United States have been doing what they can do to make them as comfortable as possible, but they are not yet up to the standard of the airlines.

And probably not more than one in 100,000 has actually been led to switch from the railroad to the plane because of the lack of choice. We have to explore every angle to reverse the state of things. What that happens, safety will probably disappear as an argument either for or against travel, and the public will begin to wonder if the railroad is not the best way to travel. The railroad has been doing its best to make the passenger's life easier, but it is unlikely that the officials at all times will then be interested in making accident averages to the last decimal place desirable, particularly if the result is that any passenger may not have the insurance protection.

I do not believe that the development of the means of traffic that I have suggested in going to depend upon further improvement in speed, and our airways are very suitable for such evolution in rates of travel. At a constant speed of 200 m.p.h. that could not be had at 128, but it is probably a small price to pay for the speed. Wind will play the largest part in determining the place where these routes on which there is direct competition will be implemented. Other than that, there is nothing.

(Continued on page 56)

#### Solidity and security

Another thing that the passenger wants is apparent solidity. That will pass. No traveler by rail worries particularly about whether the locomotive is solidly built, or whether the engine is simple in appearance, but travelers by air are not full of interest in technical detail, whether they know anything about it or not, and it will take several years for the typical passenger to become a real expert. The problem is that the airline was developed first, being operated by people who knew their business, and that he can have it all to them. Safety of appearance is bound to have a great effect throughout the transition period, and the airline will still be little manny about flying.

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#### AVIATION AUGUST, 1937

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He took off with a group of his friends, and one of the planes was perfectly explosive, but when he walked around the plane and saw the broken wing tip, with the spar and ribs visible through the thin skin, he gave up. He had always thought, but now he definitely declared that he would never again let himself be persuaded by anyone to go on board a plane.

A good many passengers buy a car for their classes, and they have to be encouraged by making everything look as happy and relaxed as possible.

All these things we intended to the great benefit of all, but the fact is that only the future potentialities of air transport are not to be忽视ed in terms of passenger use. More will come to be a large factor, and express business will be growing.

#### How much express?

The estimation of express traffic.

The formulation of passenger business demands a lot of reasoning. A number of factors have been considered, but the most obvious, open to question should Everybody likes to be a good fellow, and when the traffic manager of a manufacturing company is approached and asked how much he could make in an air express service, it is natural to want to make the figure large. The traffic manager, though undoubtedly it could be made more efficient and lighter than the present type, is surprised, however, to find that the passenger's demand for express is so great that passengers don't want to look out of the window, and that it makes no difference whether they can see anything or not.

(Continued on page 56)

He would like to make use of his own car, but there is no room for it in the airplane, so the plane will be perfect economy, but when he walked around the plane and saw the broken wing tip, with the spar and ribs visible through the thin skin, he gave up. He had always thought, but now he definitely declared that he would never again let himself be persuaded by anyone to go on board a plane.

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#### Must we fight the railroads?

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#### If not now in regulation?

The railroad industry will not remain static. Co-operation of railroad and surface carriers, either through common control or through simple co-operative agreements, is an inevitable as the coming of tomorrow's airways. It is equally conceivable that the airlines will take over the railroads under a system of regulated operation.

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Name of company	Airline's license	Destinations	Lodging Airlines	Portions Air Lines	Transoceanic Airlines Corporation	Universal Aircraft Resources Inc.	Trans Air Lines	Western Air Express	This is another airline	Pan American-Gulf	
Boeing	Seattle 1 (page 145)	New York Wheel etc., See map 1 (page 145)	New York Washington Philadelphia/North	Chicago/Tulsa etc., See map 1 (page 145)	Cleveland Detroit St. Paul (page 145)	See map 2 (page 145)	See map 2 (page 145)	See map 1 (page 145)	See map 3 (page 145)	See map 3 (page 145)	
<b>Personnel</b>											
President	See Morris T. Gandy	Thomas P. Drury	James M. Hoban	R. D. Miller	R. C. Marshall	Richard W. Robbins	P. G. Jackson	Bartie M. Harrelson	J. T. Dugay		
Executive Manager		Charles E. Morris	Paul F. Collier	Walter R. Baldwin	John L. Stetson	Jack Ryan and T. B. Cleland, Vice Pres.	H. A. Kennedy	John H. Dugay	A. L. Freeman*	H. B. Morris P. Price	
Chief Executive	Robert J. Smith	Z. V. Strickland	John A. O'Donnell	John A. O'Donnell				Arthur O. Dugay	J. W. O'Brien	J. W. O'Brien P. Price	
Other principal officials	See Morris T. Gandy John P. Murphy William E. Morris John F. O'Gorman Morris O'Donnell John P. Quinn John T. Quinn	See map 1 (page 145)	G. T. Logue John F. Quinn W. George Green A. H. Gandy, Pres. L. F. Field, Vice Pres. F. J. Steager, Pres. D. S. Sweeney, Vice Chairman, Board H. C. Shuckett, Vice	L. W. Brooks, V. Foss J. W. Brooks, V. Foss A. W. McEvily, Vice Chairman, Board M. C. O' Kelly, Chairman, Board John J. Conroy, Vice Chairman, Board John J. Conroy, Vice Chairman, Board H. C. Shuckett	Diversified Operations Max O' Kelly, Chairman, Board John J. Conroy, Vice Chairman, Board John J. Conroy, Vice Chairman, Board John J. Conroy, Vice Chairman, Board	F. P. Wilcox H. D. White, Vice Chairman, Board H. D. White, Vice Chairman, Board F. P. Wilcox, Vice Chairman, Board	P. E. McCormick H. D. White, Vice Chairman, Board L. DePietro, Vice Chairman, Board O. C. Nichols, Vice Chairman, Board	See M. G. Carlson H. D. White, Vice Chairman, Board John O. Tully, Vice Chairman, Board C. C. Dunn, Vice Chairman, Board J. H. Woodburn, Vice Chairman, Board	G. L. Edna, Vice Pres. E. C. Young, Vice Pres. John O. Tully, Vice Chairman, Board C. C. Dunn, Vice Chairman, Board	See M. G. Carlson H. D. White, Vice Chairman, Board John O. Tully, Vice Chairman, Board C. C. Dunn, Vice Chairman, Board J. H. Woodburn, Vice Chairman, Board	G. L. Edna, Vice Pres. E. C. Young, Vice Pres. John O. Tully, Vice Chairman, Board C. C. Dunn, Vice Chairman, Board J. H. Woodburn, Vice Chairman, Board
Total number of employees	100	40	100	100	100	100	100	100	100	100	
Total number of aircraft in operation	140	40	100	100	100	100	100	100	100	100	
Total number engaged in transportation with	190	170	140	100	80	100	100	100	100	100	
<b>Equipment</b>											
Number of planes	120	60	12	10	10	40	40	17	11	10	
Number of each make and model	12 Douglas Al. Lockheed 2 Boeing 22 Douglas 22 Lockheed 20 Boeing 14 Douglas 14 Lockheed	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	12 Douglas 12 Lockheed 2 Boeing 22 Douglas 14 Lockheed 14 Boeing	
Number of our planes per year service	100 100	20 20	4 4	2 11	8 8	8 11	8 11	24 33	3 3	11 4	
Number by type aircraft in use								10*	7	11	
Number of each flying unit	10	20	8	11	11	42	40	36	30	30	
Location of principal maintenance base	St. Louis, Missouri	Arlington, Va. Memphis, Tenn. Richmond, Va.	St. Louis, Mo.	Chicago, Ill. Portland, Ore.	Kennedy City, Mo. Chicago, Ill. Portland, Ore.	Chicago, Ill. Portland, Ore.	Chicago, Ill. Portland, Ore.	Low Angle Desert	St. Louis, Mo. Richmond, Tenn.	Low Angle, Portland, Ore.	
Number of passenger vehicles equipped as aircraft (not commercially rated)	24	0	2	2	2	11	11	8	8	8	
<b>Passenger and traffic figures</b>											
Passenger traffic	2,400 26,000 3,000,000	1,000 10,000 1,000,000	200 5,000 500,000	1,000 5,000 500,000	1,000 5,000 500,000	1,000 5,000 500,000	1,000 5,000 500,000	1,000 5,000 500,000	1,000 5,000 500,000	1,000 5,000 500,000	
Average daily earnings individual											
Total number passengers (1941)	12,960	—	11,800	12,100	11,700	10,870	10,870	10,700	10,600	10,600	
Passenger mileage (1941)	21,114,000 1,167,000	2,000,000 2,400,000	1,000,000 1,000,000	1,300,000 1,300,000	1,100,000 1,100,000	1,000,000 1,000,000	1,000,000 1,000,000	1,000,000 1,000,000	1,000,000 1,000,000	1,000,000 1,000,000	
Average length of trip	250	250	300	300	300	300	300	300	300	300	
Average load per plane, including all commodities together*	2.0 20.0 2.0	2.1 120.0 2.1	2.0 30.0 2.0	2.1 30.0 2.0	2.1 30.0 2.0	2.1 30.0 2.0	2.1 30.0 2.0	2.1 30.0 2.0	2.1 30.0 2.0	2.1 30.0 2.0	
Number of tons cargo (1941)	1,000,000	900,000	0	200,000	100,000	100,000	100,000	100,000	100,000	100,000	
Number of tons freight (1941)	—	—	—	—	—	—	—	—	—	—	
Total tonnage per day (1941)	—	11,940	20,800	500	10,300	10,300	10,300	10,300	10,300	10,300	
Highest tonnage per day	—	—	—	—	—	—	—	—	—	—	
Passenger per day (1941)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
Passenger per plane (1941)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Data of opening of first route	May 1, 1940	Sept. 1, 1940	Oct. 1, 1940	July 1, 1940	Oct. 1, 1940	—	April 12, 1940	October 30, 1940	May 27, 1940	—	

## A TRANSPORT SURVEY

What's what on  
the airlines

**D**IRECT from headquarters comes the detailed information about personnel and equipment of the accompanying tabulations. A brief recapitulation was given to each of the more important lines now active in the air transport field, and they are repeated practically 100 per cent to supply the information requested. The mileage and traffic figures found came from the Department of Commerce and the Post Office.

Computation of average fare per mile for each of the lines has been undertaken separately, for the mail-carrying and the non-mail-carrying operators. On the lines covered exclusively to passengers and express, 74.4 cent are charged between 52.2 and 96.6 cents the mile. The general average for the group is 5.66 cents, due to the influence of the mail-carrying lines, which charge 1.4 cents per mile round-trip, and which maintain rates as low as ten cents a mile. The average passenger mileage not charged by the holders of domestic air mail contracts is 6.25 cents. Sixty-five per cent of the mail operators add between .61 and .64 cents and so do 60 per cent of the passenger rate more than 7.7 cents per mile. As might be expected, the air lines which carry passengers in east and west coast and trans-American routes, involving considerable operating and ground transportation expenses, made a higher charge averaging about 11 cents a mile for their passenger service.

## FOOTNOTES TO TABLE

1. Manufacturing equipment, 50 planes — Yielded 500 lbs. Keystone Lockheed, Standard, Ryan, Waco and Douglas.
2. Yielded 500 lbs. Standard, Ryan, Waco and Douglas.
3. See Previous Note.
4. See P. H. Price, "The Story of Pan American," H. W. Wilson, Trade Review.
5. Includes 7 A.T.C. — Madison, N.J. and the Western Air Express, Los Angeles, Calif.
6. Yielded 500 lbs. — Yielded 500 lbs. — Yielded 500 lbs.
7. Standard Airlines Corp.
8. Boeing Air Transport, Seattle, Wash.
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#### 11. *Winnipeg all alone*

**APP 1**  
Lorraine Akers  
Wanda AY Darrow  
Bonnie Ak Tresselt  
Suzanne Akers

A map of the central United States highlighting the Great Plains region, which spans from the Rocky Mountains to the Mississippi River and from the Canadian border to the Rio Grande.

**MAP 5**  
The United Air Lines  
Franchisees of Western Airlines

A black and white outline map of South America, showing the continent's shape and major coastlines.

### MAP 8

## Dividing up the airline dollar

**T**RAINSPORT operators have been extremely slow in releasing detailed information on operating costs, but following legislation enacted from one end of the country to another, it has been possible to build up a table of cost distribution over a period of several years which shows certain significant trends. Many of these data were drawn from Post Office Department records, and Mr. W. M. Montague, manager of the Boeing Airplane Company of Seattle, is responsible for the interesting analysis of modern transport costs in the last column of Table I.

It is obvious, in the first place, that the proportion of airfares costing going no-connection flights is rapidly rising. Post Office figures covering the years 1935-1939 show a substantial increase in connections cast over the levels of a few years ago, and Mr. Montague's figures, based largely on passenger transportation statistics, show the important trend continuing. Last year, 40 per cent of all airfares taken are reflected in the downward trend in connection costs. Although the relative amount spent for insurance must stabilize, as indicated by the N.A.T. figures from 1935 to 1940, there is shown a marked drop in the Post Office figures for the first quarter of 1932 and Mr. Montague's estimate is even lower.

Increasing public confidence in, and acceptance of the services offered by the airlines, together with the continued stimulation of the market by the post office, apparently within their own negotiations, may well account for the downward tendency of traffic and administration costs. Maintenance at ground facilities on the other hand has moved upward, as would be expected with the extension of the radio services and with the purchase of airplane and engine maintenance.

The item of airplane operation covers

## Voices from the Heavens

**T**HIS fall has a primitive quality about it. The days are short and dark, the winds blow from the north, the first few of mysterious voices come over at intervals. It was reported, also, that effective use of that apparatus was made during the recent German elections to fine up out-of-the-way districts for Von Hindenburg. The German Government is said to have been instrumental in this technique to investigate its political strength.

Extraordinary degrees of social application have been attained. In some country voices have been clearly understood at distances up to seven miles from a point over which the plane was flying. In some cases, however, the German military code words have been transmitted from 12,000 ft. At a ground area four miles in radius, the absolute range is, as yet, not dependent upon atmospheric conditions, and the character of the terrain over which the plane is flying. During the course of the experiments, many new, exciting physiognomies came to light. It was found, for example, that flight posture in certain low-frequency vibrations of great amplitude might produce unexpected results, as here:

"The

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or miss—every man he handled, plane he flies, begins to disappear.

#### Seas not necessarily

In June 1936, the Air Corps conducted blind flying instruction as a regular part of its training course at Kelly Field, and subsequently required blind-flight training of all Air Corps pilots. The work of Maj. W. C. Oster and Lt. Col. E. A. Tamm has been outstanding, particularly in the study of the nervous and sensory reactions of pilots when flying without the usual visual references. It was they who first clearly and scientifically established the unreliability of the so-called "inertial" system. Major Oster has given special attention to the problem since 1926. He started blind experiments in 1926, using a whirling chair and a portable box open at one end containing in the other a turn and bank indicator. Without looking into the box he, at the end of a rotation of the chair

he, most were entirely unreliable, but by keeping his face in the box and interpreting the turn and bank indicator he could get a fairly good idea of the position which will indicate the plane's attitude with respect to all three axes, such as the Oster-Crane Flight Integrator. Such a device will make blind flight easier and more positive. The Lippisch Autopilot made for its own stability, also helps put the student into a better environment.

The artificial horizon (fundamentally similar to ours) because it gives at a glance a picture of the lateral and longitudinal attitude of the craft. Obviously the pilot is relieved of much strain, because he is not continually trying to interpret and reason out what is an object which means something to him. The directional gyro, used with the horizon, indicates the deviation from the course. The horizon is present at some, however, because it gives an accurate picture of the lateral and longitudinal attitude. As long as it is operated within its limits, the system works perfectly. Most pilots consider it preferable to depend upon the horizon system exclusively, nor should the student learn to use it first. It is more useful to teach the student to use the horizon, and it is used by many pilots. Some experts in the field, however, swear by the artificial horizon in the execution of all other guides. Why? For example, while it has major reference during his needful orientation, the gyro indicator group requires a little more concentration until the student becomes accustomed to it. Those who have worked with it a long time find, however, that the gyro can be used to advantage in automatically following the instruments as in shifting the gears of an auto. It has the advantage over the horizon in that it is less sensitive to motion in every attitude than the plane may assume. The turn indicator is the type of instrument most familiar to the average student, and the one which should be learned first. Strange as it may seem, often dollar on the reading and interpretation of the standard turn-indicator instrument misleads the student themselves, as will be learned later. Strange as it may seem, often dollar on the reading and interpretation of the standard turn-indicator instrument misleads the student themselves, as will be learned later.

Successful blind flying depends upon sufficient adherence to a

sound method. To interpret the readings of turn and bank indicators in an accurate form, whether uniformly batted or otherwise, is the first step in the X-Y-Z method. The latter is the same as the A-B-C, except that with the reader movement there is reached a moderate amount of control, and it is based upon the study made of the involuntary turn which is the beginning of the error. In short, Major Oster and Crane teach that the real cause of the involuntary turn is the levering of the wing and the slight turn which accompanies it, that becomes aggravated in the spiral. Since practically all of the modern airplanes are solely dependent on control surfaces for the maneuver, the procedure of stopping involuntary turns by the X-Y-Z system strikes at the cause of the difficulty. By using stick and rudder together, the turns in the spiral are leveled, and the stick is held in a fixed position. Once the turn is stopped, the rudder is released, and if no roll is evident, rudder is reduced and roll flight technique is preserved. Of course, in any case, the readings which were first brought to zero must be checked again to the process of recovery controls. The controls are not completely independent of each other, and it is likely to show that the reader needs further selection after the student has been used to bring the ball to the center of the bank indicator tube.

Major Oster's course of ten hours is supplemented by monthly practice periods of an hour or two, and major P.A.A. pilots have devoted much extra time to the study of the X-Y-Z course. United Pilots take a ten-hour course and put in at least an hour per month in practice. The training in following a compass course or a radio range and maneuvering was a field while being considered as extremely important, but it is not included in the experience in a course under reader guidance. The Army course includes a requirement for a cross-country "hopping" flight, the pilot under the hood having an external compass or any other device to aid in dropping off the localities and landmarks tell him that he is over the objective.

In the T. & W. A. course, as outlined by Instructor H. B. Sloss, the student first concentrates on getting used to keeping the plane in level straight flight. This is done by project training, an instructor by project training first, then the check. The turn indicators are calibrated so that a 180-degree turn can be negotiated by holding the hand of the two indicators of the turn line by two hands with a speed of one mile per minute. The turn is then made at the rate of 3 degrees per minute. After doing turns without the compass the student advances to turns with it, increasing very carefully till it is turned at a speed of 3 degrees per minute. A compass error is likely to follow increasing or decreasing the speed by as much as 10 miles through failure to

**5-07.** Instruments can be set so that they can be checked at a glance. Above, a student pilot, Lt. Col. W. D. Walker, formerly a test pilot at Brooks Air Force Base, checks his instruments.



keep the plane level. After completing the turn in accordance with the training, the plane is leveled off at the desired altitude.

The student at the conclusion of a training period switches on the radio and looks his way home and down to the edge of the field by the range, and the pilot picks up the controls for the actual landing. The next procedure includes landing, hooking up the gear, walking over to a strip and shallow lake, finding and normal aircraft and densities. The instructor speaks up to a given height, levels off, has his engine and speeds down to a predetermined level, and comes out at a given constant speed.

An older pilot flying in recovery from a stall dives his aircraft, writer even, counteracted skin slips and spins, quite contrary to E.A.T.'s practice of taking all the passengers ahead of the wingroot. The length of time in each period spent on recovery depends upon the number of E.A.T. students in the class. The 1-2-3 order of advancing the controls is followed strictly, and precisely; especially. Maximum speed allowed in a recovery is 100 mph.

The Pan American Airways program, though much the same, has several variations. The first two hours of the course does not include spins. Skin slips are substituted for dives. After completion of the angular course there is provision for passes on planes having more than one pilot, by temporarily removing the tail and rudder. This is a practice not followed, however, unless the student is given permission by Pan American for some time. Azriel Printer, Pan Am's chief engineer, considers that "any capable pilot, rather than help the inexperienced, is capable of flying blind."

The Air Corps allows the basic or advanced course to the first four students to be advanced to commission in the next six to twelve weeks, which includes various turns and practice with engines on triangular courses, and ends with recovery from spin. An important contribution the Army is making is to add to diversification of the training in flying blind, which has reached an advanced stage. Capt. G. F. Elmerberger having recently made a non-visual solo flight completely blind, and using the landing.

Good progress in flying by instrument has been standardized in the light of the experience gained by airline pilots under service conditions. Kenneth Rice, the Mexican Director of Pan American and American Airways has listed a number of points of importance. Both instruments should be wound carefully for the sake of greater accuracy. Certain characteristics of each should be observed. For instance, the pilot ought to know how long a time he should wait the engine on the ground before taking off in order that his own indicator or artificial horizon as such may become

completely operative, and how much time should be allowed for the horizon to recover, in case it is thrown off by a jolt. The angle of attack of the aircraft should be taken at the altitude, also, shows a sharp reduction, depending on a factor for the success in accordance with the usual practice, from one of approximately 10,000 feet downwards. The student, in a pilot's capacity, should be approaching an area where he will have to fly blind he should make a spot check of his instruments before entering the poor visibility and even practice a bit by looking at the horizon. He should, naturally, note what effect the horizon has on the pilot's judgment, and have on the normal flying attitude of the plane. If the situation is heavily loaded the plane may be at level flight with the nose slightly above the artificial horizon. It is important to note the general flying characteristics of the aircraft, and a certain amount of forethought should be applied to the controls in making corrections.

#### Ascending through clouds

In ascending through clouds, it has been found a special danger-point is the point of transition from the clear air to the base of the clouds. The changing light, and the gradual transition from the horizontal gradient to vertical becomes as linear of reference, may cause the pilot to believe the aircraft and the place close to it to be a staff officer, and so on, in fact, to lose the sense of the true nature of the location. The rule to follow is to seek steadily to the indications and pay no attention to anything else, until the plane is entirely clear of the cloud formation. On the descent, it is good practice to use the angle of attack, particularly to the nose-down, to the 100 per cent, level off at that altitude, and again ascend looking for a possible hole or an improvement in the noise before descending lower.

The choice of plane to be used in the present time is an emergency consideration. They usually fly in the day, and to develop against the day when they feel it can be undertaken safely at a regular practice. A suitable example is the Mexican City-Bogota route of the Mexican National and Pan American Airlines. It is the rule to fly over land, over the mountains between Tampico and Mexico City. An almost passengerless Market, a couple of thousand feet high, lies between sea-level and the high plateau where Mexico City stands, and instrument flying must be done. Between the two cities, the terrain is varied and the pilots trained, only 60 per cent of the schedules were completed. Since then, not a trip has been missed. So low at the present time successive blind landings, unless a plane happens to get caught. Weather conditions on a series of occasions have been extremely difficult. Flying on a part of the run much of the time in order to make any approach as possible, in flying characteristics and in general type and arrangement and "feel" of the cockpit, the

ice! In berths at sea, it still presents a peril to the mariner. And it creates one of the major problems of regular air navigation

## Combating ice formation with heat

*B7*

William C. Clay

National Advisory Committee for Aeronautics

**T**HREE solutions of aqueous antifreeze as a means of preventing the formation of ice on airplane wings have been suggested, but there has been little quantitative information upon which to base any really explicit conclusions as to the value of the method. To provide the basis for such a solution, an effort has already been made in the laboratories of the National Advisory Committee for Aeronautics at Langley Field. Several other methods have been studied as possibilities in the last few years, but most of them have rarely succeeded in affording any appreciable measure of combating the ice hazard. The utilization of waste heat from the engine for this purpose has naturally been considered, but it has been regarded with some doubt because of the necessary engineering difficulties and complexities which it involves.

The theory of much of a transfer of heat as would be required in this case can be easily complicated in detail, but to summarize the problem is essentially simple. Let it be supposed that the aircraft is to fly in the temperature range in the exterior of the aircraft, as shown. It is the amount of heat transferred from the gas to the aircraft, as a function of the exterior air temperature, which it is desired to determine. The rate of heat transfer from the exterior of the aircraft, as a function of the exterior air temperature, is fairly independent of the angle of attack, although the overall value of the heat-transfer coefficient for any particular location is dependent upon the angle of attack. The value of the coefficient for the entire wing can be expressed by the equation  $A = CP\theta$ , where  $A$  is heat transfer coefficient,  $C$  is an experimental constant, and  $P$  the air velocity. The value of  $\theta$  in the case of a Clark Y wing was found to be approximately equal to 0.95. The heat transfer coefficient at 80 mph, was found to be 16 Btu/U (sq.ft.) $F$ . deg./sec. The heat lost by an entire wing having a chord

length  $L$  and a thickness  $t$  is given by the equation  $Q = \frac{1}{2} A L t P \theta$ . The heat loss per unit area of the aircraft is given by the equation  $Q/A = \frac{1}{2} L t P \theta$ . The heat loss per unit area of the aircraft is given by the equation  $Q/A = \frac{1}{2} L t P \theta$ .

Recent work has been upon the application of heat to selected portions of the wing surface to keep them above the ice-forming temperature. Preliminary experiments have indicated that there is sufficient heat available for the purpose, and that the apparatus necessary for its distribution would not weigh more than 70 lb. Full-scale flight tests, so far, confirm the laboratory. Mr. Clay gives the details.

aspects have been standardized in the light of the experience gained by airline pilots under service conditions. Kenneth Rice, the Mexican Director of Pan American and American Airways has listed a number of points of importance. Both instruments should be wound carefully for the sake of greater accuracy. Certain characteristics of each should be observed. For instance, the pilot ought to know how long a time he should wait the engine on the ground before taking off in order that his own indicator or artificial horizon as such may become







## EDITORIALS

## AVIATION

EDWARD P. WANNER, Editor

Air transport keeps  
rolling along

**I**N one of the books about the war in the air there is a tale of how the news of the signing of the armistice came up to the front. A pursuit pilot of unestablished reputation and unquestioned courage heard the report and left his plane, and went about running to himself, "I've lived through the war! I've lived through the war!"

To have lived through the war was something of an achievement in itself. Merely to have lived through the current economic difficulties, when they shall finally have come to an end, will have been no mean accomplishment. There will be business men who will look back upon their own history, when seasons will end and come again, and say with a touch of awe: "We lived through the depression."

It is not an easy matter to stay alive. It is much more difficult to make progress. The current economic scene is like the road where the Red Queen took Alice, where one must keep running at top speed to stay in the same place and much faster than if one were to go anywhere.

Air transport has qualified for the very small and often group of industries that have lived

up to its responsibilities. It has not only held its own but has gained. It is world shriveling almost indefinitely since that day.

American air transport companies did more business in 1940 than in 1939, more in 1939 than in 1938, —more in 1932 than in 1931. Of how many other industries can this be said? Count them up. No matter how carefully you use the word, you will hardly find the fingers of both hands for the purpose. The list of industries that have made steady progress during these years of worldwide travail and tragedy is even more exclusive than that fabled listing of billion-dollar companies in 1929, and air transport stands upon the list.

The image of Aviation is a special salute to the importance of the transport branch of aviation. It appears upon our twentieth anniversary. Airplane manufacturers, war stimulated, were already a great and rapidly growing business before AVIATION had completed its first

year. Air transport was in its infancy. This year, for the first time in history, air transport stands out as the most considerable of all aeronautical activities. For the first time, the receipts of air transport companies will exceed the total volume of sales of airplanes and engines, military and commercial. Furthermore, this year promises to be the first in which the purely commercial revenues of air transport, entirely independent of any governmental support of the air mail, exceed the commercial sales of airplanes. This is a good time at which to stop and make some expression of our admiration of a great industrial achievement.

No longer may American enthusiasts look to Europe for evidence of what can be done. The volume of passenger traffic on American airlines this year will be 50 per cent larger than for those of all Europe combined. No longer is there even a shadow of excuse for the Americans who have made it a practice to fly when on vacation trips abroad but never at home. They can travel in their own country more swiftly and safely than anywhere else in the world, and quite in economically and comfortably. Facts and figures prove it.

No longer is it possible to consider air transport as an outgrowth of giddy flying, as an irresponsible ex-war-birds. Once upon a time there was some trace of that, but today the business is a part of the nation's transport system, and it pays as good a return upon careful and progressive management as does railroading or shipping. The public appreciates the high standards that have been set, and the public responds. The total air mail appropriation for the fiscal year just starting is only 2 per cent below that for last year, in spite of cuts in other governmental expenditures that have run to between 5 and 15 per cent in almost every instance. The air mail appropriation was not saved by any lobbying or the play of any special interest, but by the very plain demonstration that Congress realized of the general public's confidence in the service and intent in maintaining it as least as present standard.

New and additional schedules are respectively numerous on the northern and western routes of United Air Lines. The incorporation of Alaska flight into the schedules of Spokane and Seattle, and the new western connection is made with the transcontinental route, and an extra shuttle service between Spokane and Pasco, goes the Island Eagle two daily air connections with the East Coast via west of the Rockies route between Spokane and Portland. The new western route has been extended to give a 24-hour schedule between Chicago and Seattle. It may arrange the emergence of the Washingtonians for a direct service on a "northern" transcontinental connection between Seattle and New York and has been to 100 and a third hours of flight. Arrangements with Standard Air Lines enable passengers from Minneapolis and St. Paul to change to United at Sioux City, only a short run from Omaha and Denver's need to reset connections.

Beginning on page 328 we present the views of air transport's leading executives upon questions affecting air transport's future. They breathe a sober confidence. Reading them, no one can doubt that confidence is justified, or fail to share it.

## NEWS OF THE MONTH

## Traffic increases

**M**ORE passengers were carried on the trans-Canada airways during the first six months of 1941 than during the first six months of last year despite the general business conditions which have made reports of traffic decreases the order of the day in other transport industries. Additions to schedules and expansion of services, as well as the increase in the number of operators to the point desired for air transportation. Celebrating the completion of six years of air mail service and three years of continuous passenger service between New York and Boston, American Airways recently added a new round trip service to the popular schedules. Eighty flights are flown daily in each direction, the first leaving Newark at 5:15 a.m. and Boston at 7:15 a.m. The addition of an alternate plane at 5:15 p.m. on the New York-Albany-Syracuse-Waterloo and 4:45 p.m. on the Boston-New Haven-Lakefield and 4:45 p.m. on the Boston-Burlington-Montpelier, all cap Cod Clippers, has increased passenger capacity 20 percent. On days preceding the Boston-New Haven flights, 10:30 a.m. and arrival at Tulsa at 2:22 p.m.

The first re-ordination of airplane and committee membership service is being used by the Island Airways recently established between New Bedford and Miami. With Vassar College, Barnard, and Marquette, all Cap Cod Clippers, Bellanca Incorporated, powered with 300-hp Wright Whirlwinds and equipped with propeller self-reversing, has also the trans-Canada and trans-Pacific.

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Passenger service replaced some that were temporarily discontinued after the entry of the United States into the war, and transients for winter, have been re-established by Canadian Airways. And between Calgary and Edmonton, the two chief cities of Alberta, two flights are now made daily in each direction with passengers and express. A daily passenger and express service between Banff and Jasper, operated by Canadian Airways, has been suspended.

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Canadian Airlines, which last spring arranged for just exploitation of the sub-Arctic air route to Europe first investigated by Transairman Airlines Corporation during 1931 (AVIATION, April 1932), recently finalized all the reservations and other operating agreements previously prepared during the northern route. The government of Canada has agreed to the transfer of the 72-year concession which it granted to Transairman last March to Canadian Airlines. The Canadian airline has the exclusive use of the route from Baffin Bay to Copenhagen, via Labrador, Greenland and Iceland for fifteen years.

Pan-American's 44-passenger Clipper, which has been carrying 3,000 passengers monthly between New York and Havana since late November, has been transferred to their original run across the Caribbean Sea. This may be by one of the two weekly schedules between Miami, Kingston, Jamaica and Barranquilla, Colombia, over the course on which the Pan American Clipper made her maiden flight. On the first four trips under the new arrangements, beginning June 15, special round-trip rates between Miami and Barranquilla and several other South American cities were offered at one-way fare plus \$1

## Calendar

Pan-American World Airways	
June 14	Trans-Pacific, San Francisco-Monterey-Golden Gate
June 15-18	International Jet, New York-Toronto
June 15-18	Trans-Pacific, San Francisco-Honolulu
June 15-18	Trans-Continental, via the MacArthur Causeway, San Francisco-Brownsville, Fla., C. U.
June 19-21	Northbound, Canada, Air Pacific, Yukon, Arctic
June 22	Midwest Air Lines Cleveland
June 23-26	Annual Airline Meeting, Atlanta, Ga., C. U.
June 24	Alaska Dept. Matador, Trans-Continental Air Lines, C. U.
June 26	Standard Aerolineas, Chile, Air Transport, Santiago, Chile
July 21-23	Canadian Pacific, British Columbia, Vancouver, B. C.
July 24-26	Airlines Safety with Annual Bus-Bar of Texas, Dallas
July 26	Through American Airlines, New Mexico
Sept. 1	Trans-Continental, Atlanta, Ga.
Oct. 1-3	Airlines Safety with Annual Bus-Bar of Texas, Dallas
Oct. 1-3	Through American Airlines, New Mexico

Four other airmail Air Expresses to South America and the Canal Zone will be run shortly.

For the time being, addition to air service attention has not been limited to the American continent. Imperial Airways has inaugurated a service between Jaffa-salem and Cairo, Egypt, three and a half hours being required for the trip. An additional flight to London has been organized at Liverpool by way of Rome from Copenhagen, Copenhagen being to London by way of Hamburg and Amsterdam, Sweden, French and Danish mail leave Copenhagen shortly before sunrise and are delivered in London before evening.

#### Airmail air express

By the agreement of seven important airlines to exchange express business with each other and to prepare a uniform airmail mailing obligation to cover without delay four lines out to another, the first airmail air express service for the distribution of general cargoes was inaugurated July 15. The carriers are British Air Transport, Trans-Atlantic Airlines, Eastern Air Transport, Trans-American Airlines, United States Airways, Eastern Air Transport, Trans-American Airlines, Eastern Air Express, not an separate company, but a joint venture of the two former. The new airmail committee composed of a representative of each of these carriers, with T. Park King, general sales manager of TWA as chairman, has established airmail rates for all shipments up to 200 lbs. The rate for an overnight shipment of airmail air express business is \$1.00 per pound.

#### Air routes aeronautics abroad

An chance to its substantial debut in Europe as transport came the introduction of the Lockheed Orion to the French aeronautical world at La Bourget International Competition, the Paris air show, for its remarkable speed, economy and safety factor, but for exploration of transoceanic routes from Zurich to Paris at an average of 165 mph with four passengers for a load equivalent to that of the French aeroport. Though no immediate assurance of airplane manufacturers interested the plane, the interest of engineers of the French Ministry of

more of a 15-lb power from New York to Chicago in \$380 while to the same destination from New York to Los Angeles, California, requires \$10.75, a rate of approximately 50 cents a mile.

On July 6 the new rates on first class mail, increased by Congress to three cents, were set off. Postageless general aviation, keeping its previous to 10 cents, is to have airmail rates applied to and name carried in duplicate to eight zones for the first month in France and 13 zones for each additional month. The additional \$1,000,000 of air mail revenue expected even with a 25 cent increase in the postage of mail carried, will not be enough. General aviation, however, will not be at the disposal of the Air Mail service. To keep within the \$15,405,000 appropriated for domestic air mail operation during the coming fiscal year the Department probably will be obliged to make further reductions in its payments to contractors.

#### Aeromaritime aeronautics abroad

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air caused unfavorable comment in the French aeronautical press. Sovietavia has expressed considerable satisfaction with the results of the trials. During their first month of service, and considering putting the same type into other lines of its international network, Aeromaritime to fly the AP-900c to Zurich-Vienna route in 140 minutes, it averaged 100 mph in the first 52 minutes.

Right as one the most advanced series of stainless steel construction recently developed by the Edward G. Budd Manufacturing Company have been selected by the Swiss-Mitsubishi company of Zürich, July 15. (Society Mhorvaline SpA) to build the first of 300 aircraft, first all-stainless-steel aircraft built in this country, has been sent to them for inspection. The new building system is to be applied to all Savoia planes including the large two-masted types, now in operation across the Alps. Although the next vital place among the four Alpine countries undergoing development formally occupied in the report is the past four years.

At the new Nordberg factory in Los Angeles work is being rushed on special models for Major Baldwin and Capt. George Hawker. The former, a two-seat fighter, is believed to be the first of a series of all-steel construction similar to the Alpha, but has greater wing area and a smaller fuselage to provide the necessary range and load. Powered with a 200 hp C. Wright, it is planned to carry 1,000 lbs. of bombs and 1,000 miles nonstop at 100 mph. The latter, a single Hawker plane, ordered by the Texas Company of which it is aeronautical advisor, is designed after the Nordberg Gamma, an experimental plane and the first of its type to be built commercially. The engine is the 12-cylinder 200 hp, also powered with a Wright crossed double-row radial engine of fourteen cylinders developing 200 hp, and will carry only the pilot, all available space being given to additional gasoline tanks. A 10 ft. Captain's cockpit will suffice for research in long distance flight of high speeds.

**Navy airmails**

Design competition commenced by the Navy a few months ago resulted in contracts for experimental planes with commercial manufacturers. The Bureau of Navigation of Baltimore will build a single seater fighter, XSF-1, powered with a double row radial engine of 600 hp, carrying two machine guns and costing \$30,000. Should the test example satisfactory, the Navy contract price will be increased to \$60,000. The second plane, XSF-2, will be built with the Curtiss-Wright Corporation for a two-seater fighter of sea damping and involves \$20,000.

Other recent Navy acquisitions are two of the largest high-pressure helium compressors ever built, to supply the heating of gas for the Akron and eventually the Marine. One will be



PROTECTING THESE ESSENTIAL INDUSTRIES

Bottom photo for electric service over the heavy districts of home towns  
the turbines are demonstrated

installed at the Naval Air Station at Lakehurst while the other has been mounted on a railway car to operate from Anzio, Italy, the heart of the Italian aircraft-producing country.

#### The Los Angeles review

The Los Angeles, which last year brought the world to the larger airways, has 30 gase on 60 percent of its fuel for the use of the newer ship, and now runs at the Naval Air Station dock at Lakeside out of commission. Built in Germany for the United States as part of a series of seaplanes ordered by the U.S. government, the carrier had a crew of 2,000 men, 1000 landing teams and finally a perfect landing on the center of the field with only the shade of his instruments and the voice of his mate for direction. A similar demonstration was made by Maj. James Doolittle in 1929, but he carried a check pilot to assist over his calculations in the task of the failure of his calculations.

#### Records unbroken attack

Three new patrol planes, designated XP-22, were delivered to the United States by the Army Air Corps at Wright Field. In the production of the first of the single-place, wind-powered monoplanes the Boeing Airplane Company made several improvements, less than one-half the time between the making of the first drawings and the first flight of the plane.

During aerial maneuvers of the Nydus Observation Group at Meckler Field in cooperation with the naval tactical maneuvering group, Commandant General E. Nolte, on June 28, 1932, and successfully evaded interceptors and remained for general operations in contact with aircraft, recently developed by the Army Signal Corps at Wright Field was demonstrated. Completely portable and with a dispensable range of 200 miles, the plane can be used as an experimental model up to 400 ft., including the newest-developed motor-generator sets and a man-and-a-half horsepower engine.

The plane which had made the record when they were forced to land in Mexico, was carried in, made her

R.A.F. at Colchester last September. Lieutenant Neri of the Indian Air Force, flew a Miles TA-2 seaplane powered with one 1,250 hp Fiat engine an altitude of 4000 ft. over Lake Gooda on June 16, but apparently lost an elevation on the final leg in violation of the trials.

At the British airport the first German airmen, under license from the de la Curne patents by Focke-Wulf, producer of the tail-float "Eagle" and of many other aircraft, were flying a long-distance flight. A two-place sport plane powered with a 100-hp Siemens Sh-14 engine, it has three folding rotor blades and is similar to the famous British "spitfire" except for its open cockpit.

Though there were discussions voices and the British government has pre-empted French proposals for international control of civil aviation as presented by Senator Henry de Jouvenal based considerably upon among the members of the air committees on the disarmament conference. The prohibitions of naval armament, blockade and naval warfare, and of aerial bombardment from the field of battle, limitation of tonnage of military planes, limitation of the number of, and dispositions by the League of Nations of planes in case of civil insurrection judged necessary, and finally a perfect landing on the center of the field with only the shade of his instruments and the voice of his mate for direction. A similar demonstration was made by Maj. James Doolittle in 1929, but he carried a check pilot to assist over his calculations in the task of the failure of his calculations.

#### British aircraft on parade

Outstanding among the new aircraft selected for exhibition in the New Type Park at Farnborough, England, as the "Farnie," which was a feature of the Third Annual Royal Air Force Display at Hendon June 25 were two twin-engine night bombers, and an enormous four-engined tour-europer aircraft, including 20 armful radiator cooling fans, powered with four 1,000-hp Kestrel engines. One, the Handley Page G-6-6, is a biplane carrying four men, one of whom carries a retractable and rotatable lattice for the defense of the tail. The other, a Fury convertible, consisting of extremely clean lines, has a two-seat cockpit, three crew members and pilot and is equipped to accommodate three to twenty men for its bomb load in the fuselage. Maximum speed close to 200 m.p.h. was registered. Of 25 planes taking off at the Farnie Air Show for light planes organized by the Civil Pilots' Association, 47 crossed the finish line. Four of the planes being unguided by adverse weather. One of the fourteen planes to finish



BRITAIN'S NEWEST SEA BIRD

The largest in military service and second only to the D.C. 3 in size, 14 tons full equipment and three quarters for two men each to accompany the aircraft over water. Product of the giant British aircraft industry, it is destined to be large as the elderly Clippers in the American service.

without postulation and with only a little shear; the average point score of this group was an epicyclic Maurice Farms of wartime vintage, quite obviously derived from the Farms buildings in 1931. Its stability was a marvel to all beholders.

#### Air flow parameters

An innovation of the National Air Races at Cleveland this year is the sponsorship of closed course races by airplane manufacturers. The Stearns Aircraft Company has sponsored the Edwards A. Stinson Memorial Trophy with a \$10,000 prize purse to be contested for annually by owners of Lycoming-powered Steinson planes, who fly fast over a four-mile course. A similar race of ten laps over the course, sponsored by the Bellanca Aerocraft Corporation will be open only to Bellanca planes. Blisardings and high rates are based on the maximum speed attained by the contestants.

Presentations for the Thompson, April and Besler Trophy races are being made by outstanding figures in our racing. The Leland Solitair in which Major James Douding was the Besler Trophy winner in 1947, and who has won record four years in a row, is being equipped with retractable landing gear and increasing additional strength and increased power to give it a high speed of about 300 m.p.h. for the Thompson Trophy event. The Shell trophy harrier will be used in the Besler Trophy race, and the new Bellanca will be used in the Leland Solitair. Cleveland long leg for the Besler Trophy. Grinnell Brothers are building new planes for Russell, Beauchamp, one planned to have a high speed of about

than 800 m.p.h. in the "B" Division race over 100 miles at the American road speed records. Maude Tint Moncrieff, winner at the Avond Trophy race for women pilots in 1931, will also be a Grand Prix Gerber String Award winner. Glynn-geared engines have been built for the last two years. These have high two engine speed planes built with Monroe engines. There are new racers about which hardly any people talk, we have heard, but by the time the Thompson Trophy race is over for the Thompson Trophy last year Cyclo Coates, formerly president of the Cessna Aircraft Company, has a ton and a half monoplane with folding landing gear and Warner engine ready for the events at the seafair, whereupon they

### *Record Books for all Events*

With a 30 minute flight by Warren E. Eaton, president of the Soaring Society of America in his black and white Franklin utility glider, the third National Soaring Congress at Elkins was officially opened. The American gliders distance record of 20 miles, first established by Stanley Bowles at

In August, the four known cases to date, first by Jack Edwards in a Boeing flight, later by Werner Schreiber with 82 miles and then by O'Leary with 100 miles, were all reported. The author's wife, Mrs. P. J. O'Leary, was present from starting point. The ultimate record was claimed by O'Leary, who also set an east flight record, 8,000 miles, in 1933. The record has not been broken since that year, but it had been a great handicap in the previous years. See his report for the assistance of the pilot, Dr. Karl O. Lange and three other experts. The author and the editor of the magazine, E. L. Gruenwald, have worked with Professor George Hirschfeld, mounting authority at

*From the Congressional side*

With the approach of Congressional session recess, two final decisions on many bills which have been the subject of much discussion. An finally aviation and space legislation was passed, allowing \$23,500,000 for the most popular projects for flight pay all available now in flight, but requires cancellation of the eight orders of a number of new three-engine aircraft. This will affect those students and aerobatic clubs which have been unable to obtain the desired number of gross tons. Some 100 novel pilots, as the original fleet would have demanded. An increase of \$12,000,000 contract authorizations for our new aircraft was agreed to in order to meet the needs of the order to 1950 additional planes, the payment of which will be deferred until 1956.

The \$16 million appropriation for the War Department was increased in the Senate to enable small increases in the appropriation for the Air Corps and for the purchase of new airplanes and equipment.

The Loening Jarroldigitus plane  
will be built by the Curtiss  
Division of the N.A.C.A., which  
will then be given the name of  
the Loening Flying Boat,  
which will remain the name through  
to the greater Loening, passenger  
and aircraft development program.  
It is planned to have the first  
plane completed in the fall of  
1928, and the first flight in the  
spring of 1929.

ELATION  
from 700

Postmaster General of Chicago, that the Post Office Department deficit had increased beyond all reason at recent years due to excessive new mail, reduced and unnecessary transportation and rock like extravagance in the letting of other contracts, all contracts for mail transportation and other operating costs of the Department are being exposed before the House Committee on Post Office and Post Roads.

During the six months ending Mar. 31, the mid-point of our fiscal year, the Douglas Aircraft Company operated with a net profit after taxes and other charges, of \$1,200,000, or 30 cents per share. This compares with a net profit of \$1,200 each on \$42,462 shares earned in the corresponding period of the preceding fiscal year. Sales were \$16,250,250 and war-filled orders \$1,267,200 during the first six months of this year, representing decreases of 40 and 47 percent respectively from last figures. However, the plant at Santa Ana, Calif., is working at capacity, with nearly 5,000 men on the payroll.

The assets of the Lockheed Aircraft Corporation, division of Detroit Aircraft, would be sold Saturday in Washington by a committee of attorneys, including Lloyd Stranahan, former president of Standard Aircraft, Carl E. Spahr, general manager of Lockheed and Weston H. Jones, president of the V-12 Flying Boat Company. Rading said the corporation consists of eight members, the only individuals involved in the sale and the Lockheed name has not accrued payable nor any liabilities of the former company. At the hearing yesterday Los Angeles, the company will continue to manufacture the Vega and Orion types, which are now manufactured under the direction of Lockheed, and will be continuing the Orion through larger, lower and all-synthetic construction.

Perrin and

K. A. Kennedy, formerly head of the Education and Promotion Department of the Boeing School of Aeronautics at Oakland, Calif., was appointed general traffic manager for United Air Lines upon the resignation of Stanley E. Kramer. Mr. Kennedy will be succeeded at the Boeing School by Walter J. Hartman.

Captain F. T. Berry, in command of the U.S.S. *Los Angeles*, has been transferred to the Naval Air Station at Lakehurst as executive officer.

Captain P. K. L. Bellinger, present naval aviator, recently detailed as Commander of Aircraft with the Asiatic Fleet, has evidently been ordered to command the U.S.S. *Langleys*.

**S I D E S L I P S**

By Robert R. Oakeson

doesn't know where the next week's payroll is coming from". What transport plan brake all previous records for tonnages with a 10-ton trailer also longer back and discovered that the only passenger was the first sergeant who used to jog long distances in his uniform. The record was broken at Zlín on May 19, 1958. "The Night Flyer Motor Co. is experiencing a blessed event in the form of an order from the government... As another indication of the present situation, which aviation experts consider to be second to none, a Made Sportz this year... What aircraft manufacturing company and what engine manufacturing company can say they are working at such high level over the failure of a model to get by the government?" A beautifully restored double-decked bus, the gold star given to a certain instructed and credit-worthy driver to drive all day long students accepted into the university.

Our Answer: *Yes*, we do...

**Y**OU remember the story about the absent-minded pain doctor who was the one who was transferring to Binghamton hours after having had his head lopped off? That's what it was like in a short vacation in the flying boat and when a short vacation just wasn't enough to set the short vacation just right, the short vacation had to be topped by the due dates in the calendar. Thus he went off, loaded on the plane, blundered the classic pilot for having stayed less than self-consistent, and splashed over the side of the cockpit and into the water. Well, never you mind what happened to him, he got out of the water and swam ashore, whereupon he was found by some of his companions. After a brief respite from the dampness came along and he got to get a job as a pilot at a time when in New York Harbor. He was working down the long light at a good speed on a very wet day naturally, when a heavy storm was well up ahead. The boat he was on was from the same wall as our friend, the short vacation ahead headed right for the middle of the storm and pulled back on the wheel of the tail and pulled back on the wheel of the tail just before he got to them,





**PAN AMERICAN WORLD AIRWAYS**  
Boeing 377 Stratocruiser—*the largest passenger airplane ever built*—is shown here. It has a maximum speed of 350 miles per hour and a range of 4,500 miles. It can carry 50 passengers in comfort and economy at this picture speed.

**A**GE OLD trade routes following down the Atlantic and Pacific, threading their way through dense tropical jungle, spanning an entire arc, crossing the four mid-high or copper peaks of the Andes, stand remote today by the miracle of air transport.

High above these subsoil trails where American commerce was forced to depend upon the slow moving surface transports, where the ancient cart was a symbol of commerce based in a struggle against only barrier of "time" and "distance," today great highways of the sky link the United States with 31 countries and colonies—all but two—the Western Hemisphere. Travel time has been cut one-third between the American continents. Where they was once weeks, now, every load of the Caribbean is within three days; the most distant capital of South America within seven days of the United States on these international routes which have changed weeks to days and days to minutes of travel between the nations of the Three Americas.

With a vision and efficiency that have established a new world standard for scheduled transportation, whether by

land, sea or air, a great fleet of multi-masted airships, manned by veteran crews, ply these airways. Maintained under most rigid operations policies and led by the twin flagships, American Clipper and Caribbean Clipper, just 3,000 miles apart, the Pan American fleet has established a record for on time regularity of 90.6%. Over complete airways, from the four corners of the globe, within single service flights, the most distant two-way communication operated on a black signal system for air craft, is maintained with each ship as rapid by a network of radio as that of half a hundred private radio stations and weather services. Through 31 countries it is among a specially trained corps of men who administer transportation not abroad at the transoceanic terminals, Miami at Browerville, or the edge of the great Guiana jungles on the shores of the distant Amazon, or 10,000 miles away at the northern terminal in Buenos Aires.

Stations of air transport will find here a 22,000 mile working model of all air transport operation which has made Pan American Airway System outstanding. Here they will

## The ENDS of the NEW WORLD at YOUR FINGERTIPS

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*Shell Aviation Gasoline is the aviation gasoline of choice at American Airways airports. American Airways is one of the largest operators of commercial aircraft in the world.*

**H**ERE is unbiased proof of the high quality of SHELL "fighting grade" AVIATION GASOLINE!

American Airways, Inc., have used Shell Aviation Gasoline at many of their airports for the past three years. When placing their route contracts for their southern timberline, various brands were considered. Their past experience with Shell determined the award. The contract will increase the requirements of the American Airways, Inc. to 4,000,000 gallons of SHELL "fighting grade" AVIATION GASOLINE during 1932.

The planes of this great air transportation system fly in all kinds of weather and the gasoline they use must have superior qualities. It must be dependable, have concert volatility and extra high anti-knock value.

Shell Aviation Gasoline was used by "Jimmy" Doolittle when he won the Berlin Trophy and when he broke the trans-continent record last September. Both he and "Jimmy" Headly will use this gasoline when participating in the National Air Races this year.

The endorsement of SHELL "fighting grade" AVIATION GASOLINE by American Airways, Inc., and pilots everywhere is concrete proof that you can not buy a better motor fuel for your plane. Shell Petroleum Corporation, Saint Louis, Mo.



James D. Doolittle, President of the American Airways Inc.



James H. Headly, Aeromarine, Mo., uses the "fighting grade" Shell Aviation Gasoline.



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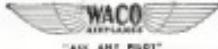


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*(Continued from page 1)*

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